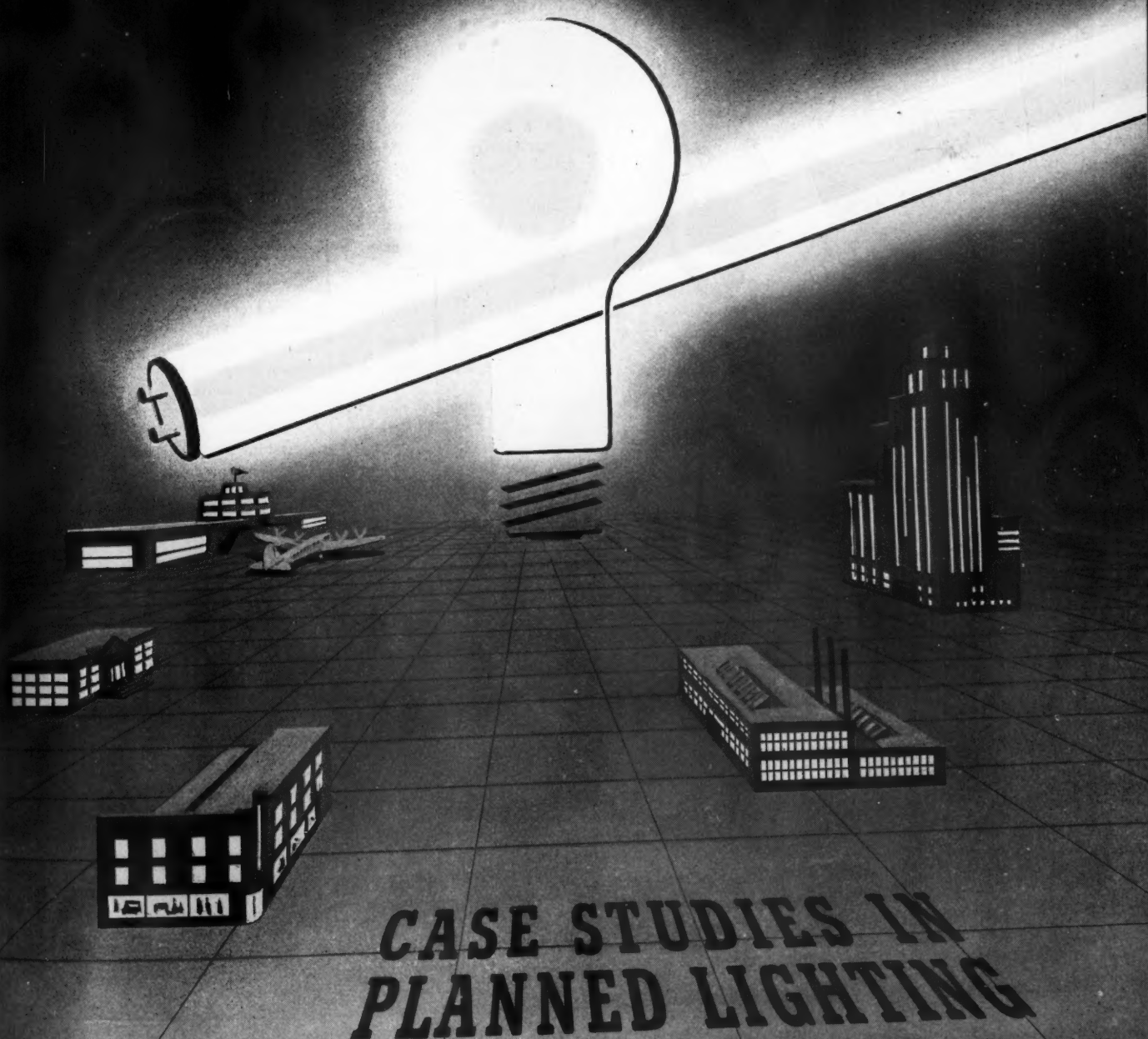


Electrical Contracting

OCT
1944

The Magazine of

ELECTRICAL CONSTRUCTION AND MAINTENANCE



**CASE STUDIES IN
PLANNED LIGHTING**



L-66

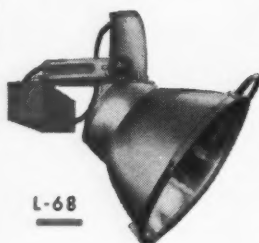


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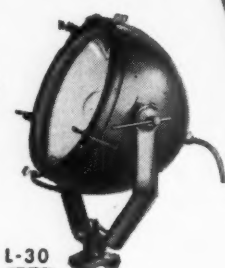


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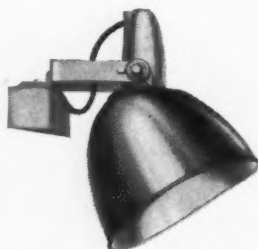
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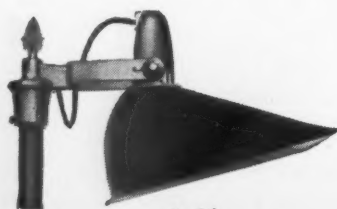
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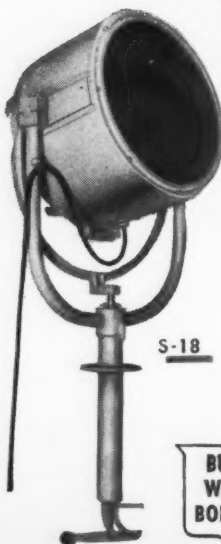
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L-45



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S-18



YOU CAN RENDER ADDITIONAL SERVICE by offering properly planned **FLOODLIGHTING**

TAKE ADVANTAGE OF G-E TECHNICAL ASSISTANCE AND THE WIDE RANGE OF NOVALUX EQUIPMENT

● Maybe you never expect to "see your name in lights." But every good job of floodlighting you install enhances your reputation. Therefore, take advantage of the twofold help offered by General Electric:

1. An extensive line of moderately priced, high-quality floodlights which will enable you to meet any floodlighting requirement. Typical of the G-E line are the popular units illustrated, and listed below.
2. Expert help in selecting and applying the right type and number of lights for the job. Such help is available from trained lighting specialists of General Electric and its authorized agents, or from the G-E Illuminating Laboratory at Schenectady.

As a first step to becoming *floodlighting headquarters* in your territory, get in touch with our nearest office, or authorized agent. *General Electric Company, Schenectady, N. Y.*

A few of the more popular NOVALUX FLOODLIGHTS

TYPE	WATTAGE	GENERAL CLASSIFICATION	APPROXIMATE NET PRICE RANGE
L-66	200	General Purpose	\$8.25
L-38	200/250	Heavy Duty	
		General Purpose	\$25.42
L-49	300/500	General Purpose	\$18.10 to \$21.42
L-30	300/500	Heavy Duty	
		General Purpose	\$45.60
L-43	750/1000	General Purpose	\$23.42 to \$26.80
L-45	750/1500	Area Floodlight	\$11.40 to \$16.75
L-46	750/1500	Area Floodlight	\$18.75 to \$25.10
L-68	750/1500	Area Floodlight	\$28.10 to \$32.90
S-18	900/1500	Searchlight	\$134.00 to \$214.40



NOVALUX
Floodlights

GENERAL  ELECTRIC

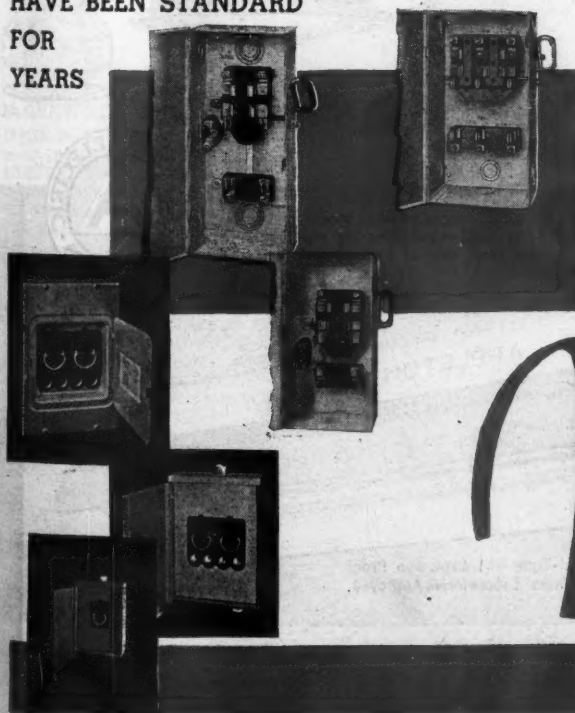
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SOLDERLESS CONNECTORS THAT HOLD LIKE A VISE!

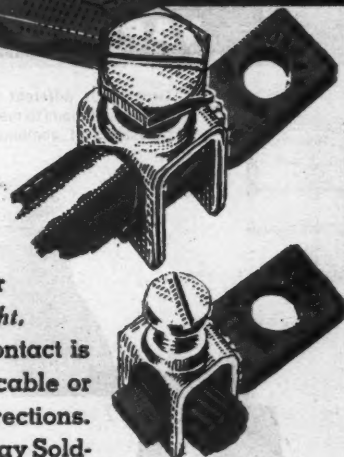


FROM YOUR JOBBER — HE HAS THEM
IN CONVENIENT, ECONOMY PACKAGES!

SOME FAMED MURRAY SWITCHES IN
WHICH MURRAY SOLDERLESS CONNECTORS
HAVE BEEN STANDARD
FOR
YEARS



So strong that they'll take
all the tightening you will ever
give them. When they're tight,
they HOLD—and electrical contact is
absolute. You can insert the cable or
wire from any of three directions.
These speedily-installed Murray Sol-
derless Connectors have been stand-
ard in Murray Switches for years.
Metropolitan Device Corporation,
Brooklyn, N. Y.



SOLDERLESS CONNECTORS

by

Murray

Metropolitan Device Corporation
Brooklyn, N. Y.

See price list and complete line
Solderless Connectors

Name _____

Address _____

Precision

★ DESIGN
★ ENGINEERING
★ CONSTRUCTION



Work For You When You Specify APPLETON LIGHTING EQUIPMENT

Appleton Vaportight, Dust-Tight and Explosion-Proof Lighting Fixtures offer a wide

margin of safety... throughout a complete line answering every exacting lighting requirement.

Precision design, engineering and construction, which give neater, safer installations, also provide roomy interiors for wiring and splices. All Appleton Lighting Fixtures are tested and approved by Underwriters' Laboratories.

The Appleton Explosion-Proof Fluorescent Lighting Fixture—the first of its kind in America—is simple to install and maintain. The line connection is easily made. New

lamps are quickly placed. Ballast is conveniently reached.

The complete Appleton line of conduit fittings and lighting fixtures—15,000 types and sizes—is illustrated and described in the Appleton catalog. Make it "Your Guide To Better Wiring."

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

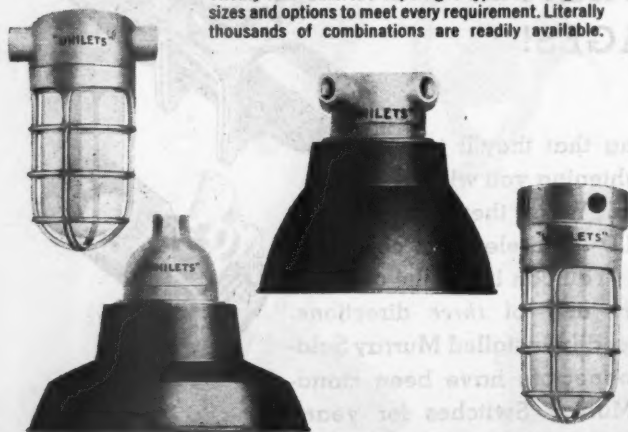
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VAPORTIGHT

Twenty-four different Vaportight types in range of sizes and options to meet every requirement. Literally thousands of combinations are readily available.



DUST-TIGHT

Cniling, bracket and pendent types for use with or without guards and reflectors, all with dust-tight seal. Streamlined to prevent dust accumulation.



EXPLOSION-PROOF

A skillfully designed, ruggedly built Explosion-Proof Fixture for every need—including the new, exclusive fluorescent type, first of its kind in America.



All Appleton Vaportight, Dust-Tight and Explosion-Proof Lighting Fixtures are Underwriters' Laboratories Approved.

A P P L E T O N

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Electrical Contracting

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How a new cleaning booth with filtered fluid recirculating system speeds cleaning operations.

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An infra-red oven designed to bake electric drill armatures as they rotate within a circle of heat lamps.

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By F. W. WILLEY—An outline of some basic principles to use in collecting slow accounts.

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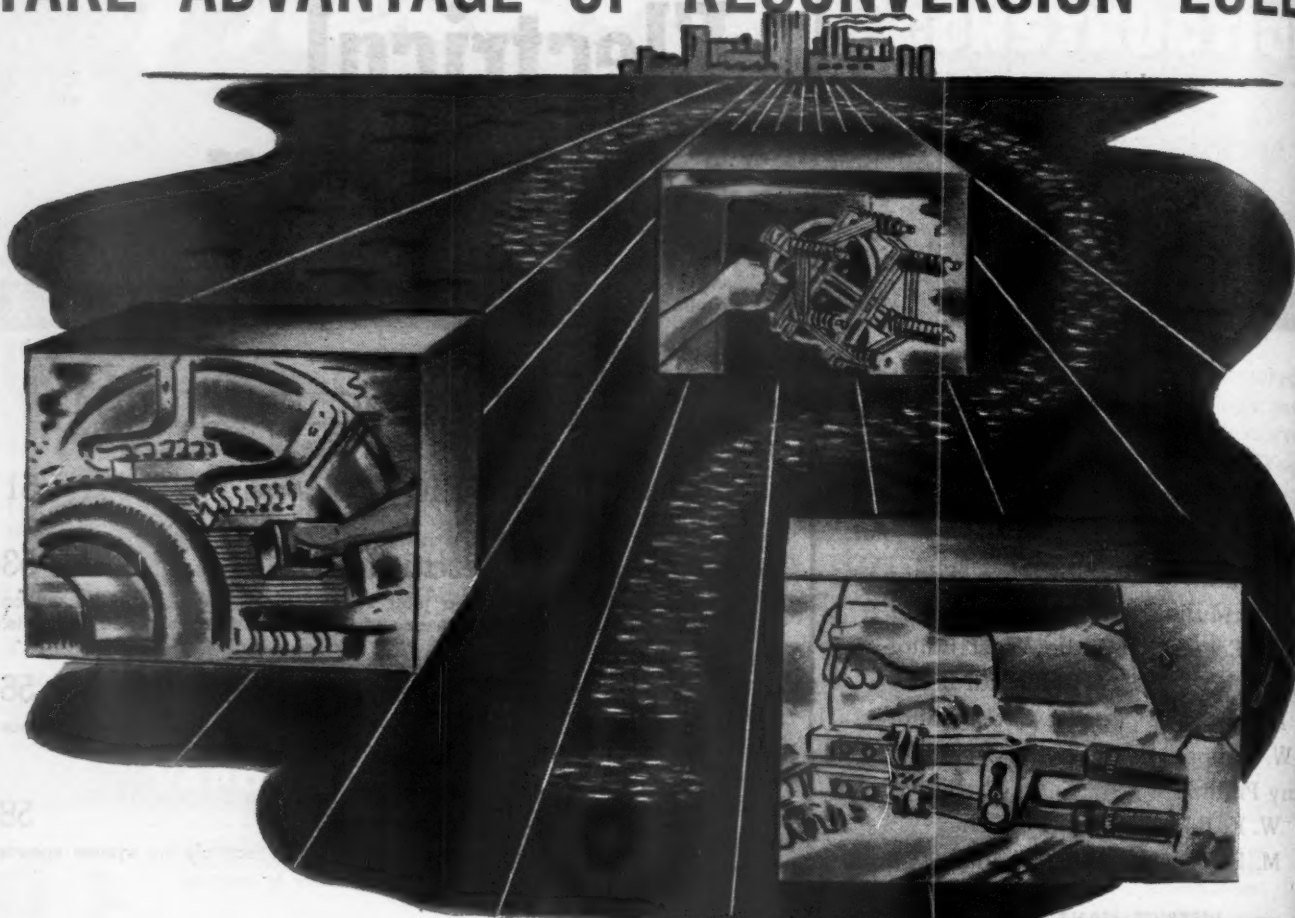
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A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops covering engineering, installation, repairing, maintenance and management in the field of electrical construction and maintenance.

TAKE ADVANTAGE OF RECONVERSION LULL



Use Modern IDEAL Motor Maintenance and Repair Equipment to Restore Motor and Generator Efficiency ... INEXPENSIVELY!

There is a big post-war job ahead, restoring to tip-top condition motors and generators war-weary from their years of gruelling "round-the-clock" service. IDEAL's complete line of Motor Maintenance Equipment quickly reconditions over-worked motors and generators *without taking them out of service*. The IDEAL line of money-saving equipment includes **100 products** serving more than **40,000 customers** through **200 IDEAL Service Engineers**. Stocks carried at the plant, in warehouses and with wholesalers in all principal cities.

Ask for the 88-page IDEAL Handbook giving complete information.

IDEAL Sycamore
IDEAL COMMUTATOR DRESSER COMPANY
1041 Park Avenue • Sycamore, Illinois

OVER 100 PRODUCTS TO HELP ELECTRICITY SERVE BETTER

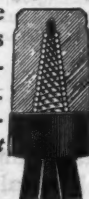
MUCH PLANT REWIRING WILL BE NEEDED—USE IDEAL "WIRE-NUTS"...



wires—screw on—that's all. These solderless, tapeless wire connectors make a neater, safer wire joint—better electrically, stronger mechanically. Approved by Underwriters' Laboratories, Inc., and are *available without priority*.

for lower-cost wire joints when making plant changes such as adding new circuits, making temporary installations and re-locating machinery. Just a pocketful of "Wire-Nuts" and a wire stripper are all you need. No fussing.

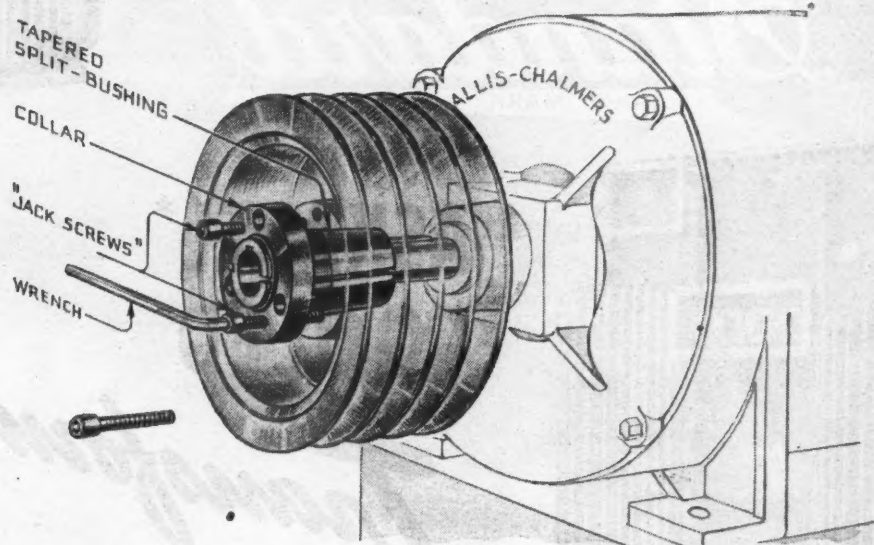
Easy to use. Simply strip



STOCK DELIVERY
SOLD THROUGH JOBBERS

X-Ray View

OF ALLIS-CHALMERS' NEW "MAGIC-GRIP" SHEAVE



Fastest mounting and demounting sheave on the market, the new "Magic-Grip" costs you nothing extra.



1 Remove three capscrews from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.



2 Insert two capscrews in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.



3 Remove sheave from shaft. Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1770

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"MAGIC-GRIP"



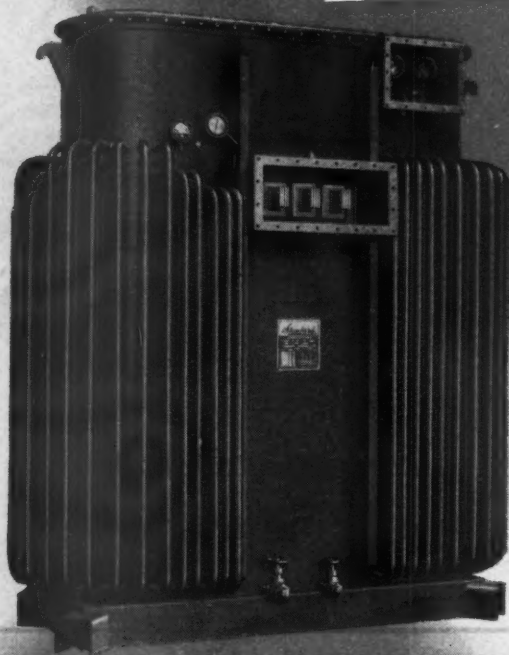
SHEAVES

Standard Askarel-Cooled distribution transformer . . . 250 Kva, 2300-115/230 volt, single phase, 60 cycle.



To save space, reduce costs
with complete safety

SPECIFY
Standard
TRADE MARK



ASKAREL*
COOLED

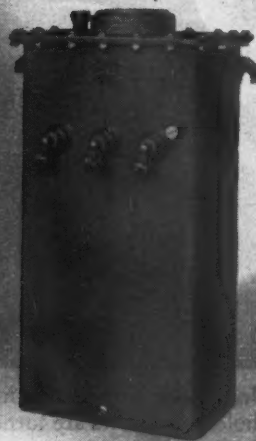
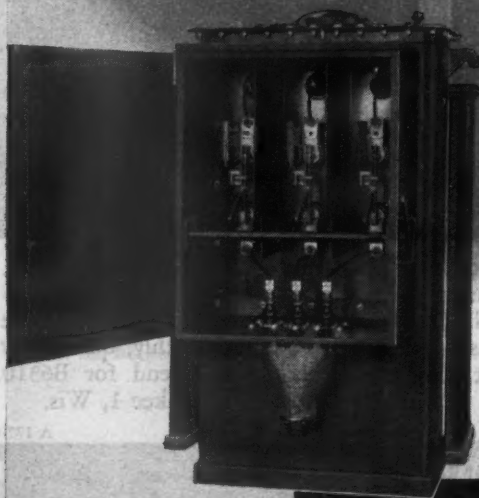
Transformers

For industrial plants or commercial buildings, you can save time and floor space by installing Standard ASKAREL-COOLED Transformers. Built to AIEE and NEMA specifications, these Standard units are *entirely safe and approved* for use up to rated capacities

outdoors or indoors without separate housing or vaults. Good engineering on your part takes advantage of Standard Askarel economies to improve your proposals.

Some of the more popular designs are illustrated here. Capacities up to 10,000 Kva are available.

2300 Kva, three phase, Askarel-Cooled Standard Power Transformer. Years of user experience has proved the economy and dependability of Standard Askarel-Cooled Transformers.



Design typical of ratings up to 50 Kva inclusive. High and low voltage terminals can be arranged for housing with switch and fuses as specified.

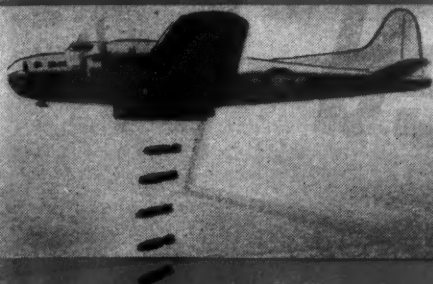
By locating this distribution transformer near the load center, costly runs of low-voltage wiring are saved. Many Standard Transformers are now furnished with switching equipment installed in an attached cabinet as shown here. Being Askarel-Cooled, it is safe anywhere.

*ASKAREL, a non-inflammable, non-explosive liquid is approved by the Underwriters Laboratories to be used as an insulating and cooling medium. The National Electric Code allows Askarel-filled transformers to be installed indoors without fireproofing. Write for Bulletin S-101.

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO

Makers of: Power, Distribution, Rural, Instrument, Street Lighting and Testing Transformers . . . Oil, Askarel or Air Cooled

FROM BOMB SIGHTS



... BACK TO PEACETIME PRODUCTS



BULLDOG WILL SPEED RECONVERSION

All industry, during the war, has learned that good lighting pays for itself many times over — in bigger output, better work, less spoilage, and employee health.

Plants equipped with BullDog Universal Trol-E-Duct will find its advantages multiplied in the reconversion period, and in the peacetime competitive race to come.

It is the only system that provides completely flexible lighting. It brings lights close to the work — permits you to add new lights or re-locate present ones, instantly and wherever needed.

Expert BullDog engineers are ready to help you now in your postwar preparation. Write for information about Bull-Dog Universal Trol-E-Duct and its companion systems — BUStrIBUTION DUCT for flexible power and Industrial Trol-E-Duct for portable tools, cranes, hoists and other moving loads.



BULLDOG
ELECTRIC PRODUCTS CO.

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Canada, Ltd., Toronto, Ont.



Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCH-
BOARDS • SAFTOFUSE PANEL BOARDS • CIRCUIT
MASTER BREAKERS • UNIVERSAL TROL-E-DUCT
• INDUSTRIAL TROL-E-DUCT.

Any type of light can be suspended from Universal-Trol-E-Duct — the Duct serving as both support and feed. Trolleys or Plugs inserted in the Duct convey current from the Duct to the lighting fixtures.

for... Speed

Low Cost

In Re-maintenance

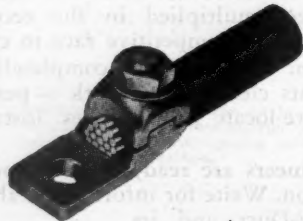
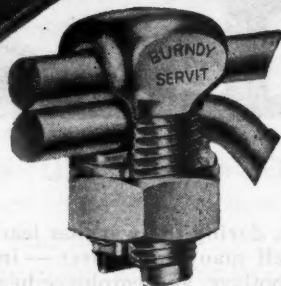
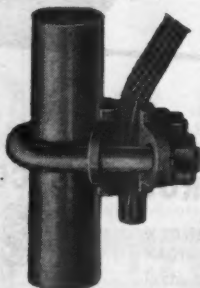
Connect With the Line of Least Resistance!

The war record of the electrical industry in "holding the line" under unprecedented power demands, and the shortages of materials and manpower, is a *monument of praise* to the maintenance engineers whose planning and "know-how" enabled them to conquer problems heretofore thought impossible.

This same "know-how" is now being brought to bear on the big re-maintenance job just ahead . . . to insure maximum efficiency and *permanency* of many war-born installations.

Logically, Burndy engineers are cooperating on many of these programs, for wherever *speed*, *permanency* and *low-cost* are the prime connector requirements, Burndy has the answer. This complete connector engineering service is yours, too, for the asking. Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y.

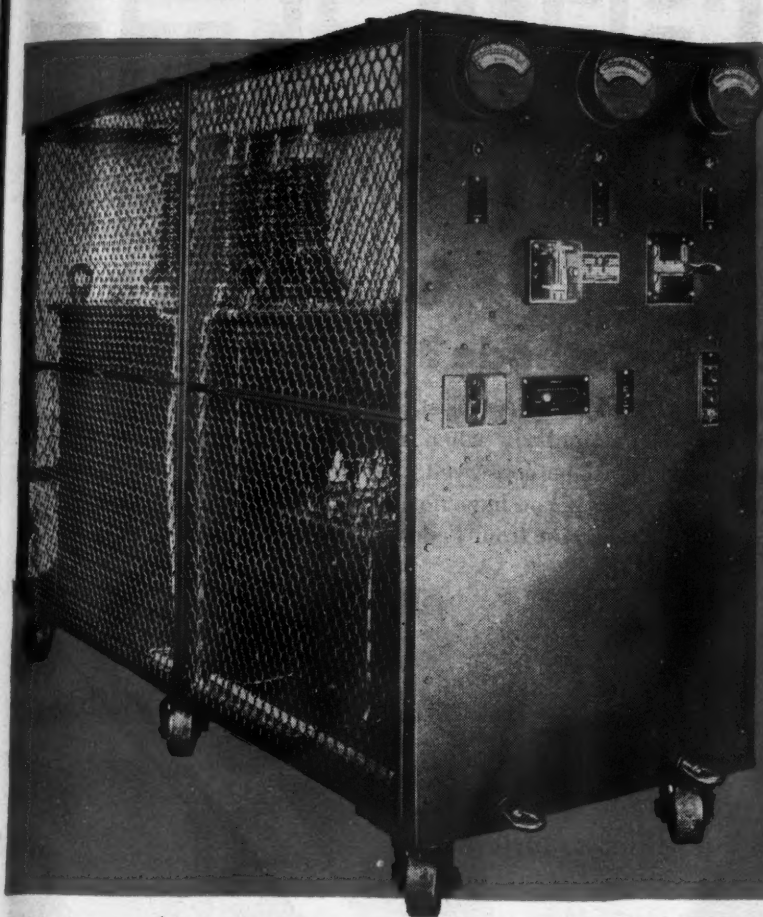
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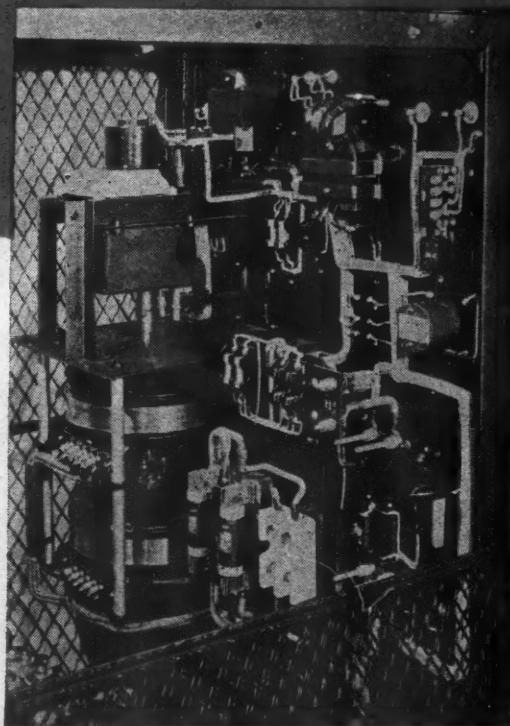
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AMERTRAN HIGH VOLTAGE TEST SETS



Retain Calibration
Reduce Manual
and
Visual Errors



Improved reliability of AmerTran High Voltage Test Sets is readily apparent under operating conditions. Recalibrating intervals are usually lengthened—a substantial time saving that results from combining precision and sturdiness to an unusual degree. This sustained accuracy wins operator confidence, as do the positive acting, easily manipulated controls and quickly read dials. Built-in safeguards protect both operator and equipment. An important advantage is their versatility—multiple secondaries allow quick output range adjustments within which Transtat Regulators provide close control in small voltage increments.

Comprising many models, AmerTran High Voltage Test Sets have ample facilities for all kinds of dielectric and general testing involving voltage application of any required duration. Into each unit goes the same craftsmanship that has made AmerTran the standard for electrical testing in leading industries, utilities and universities since 1901. Write for complete details.

THE AMERICAN TRANSFORMER COMPANY
178 EMMET STREET NEWARK 5, N. J.

Pioneer Manufacturers
of Transformers, Reactors
and Rectifiers for Electronics
and Power Transmission

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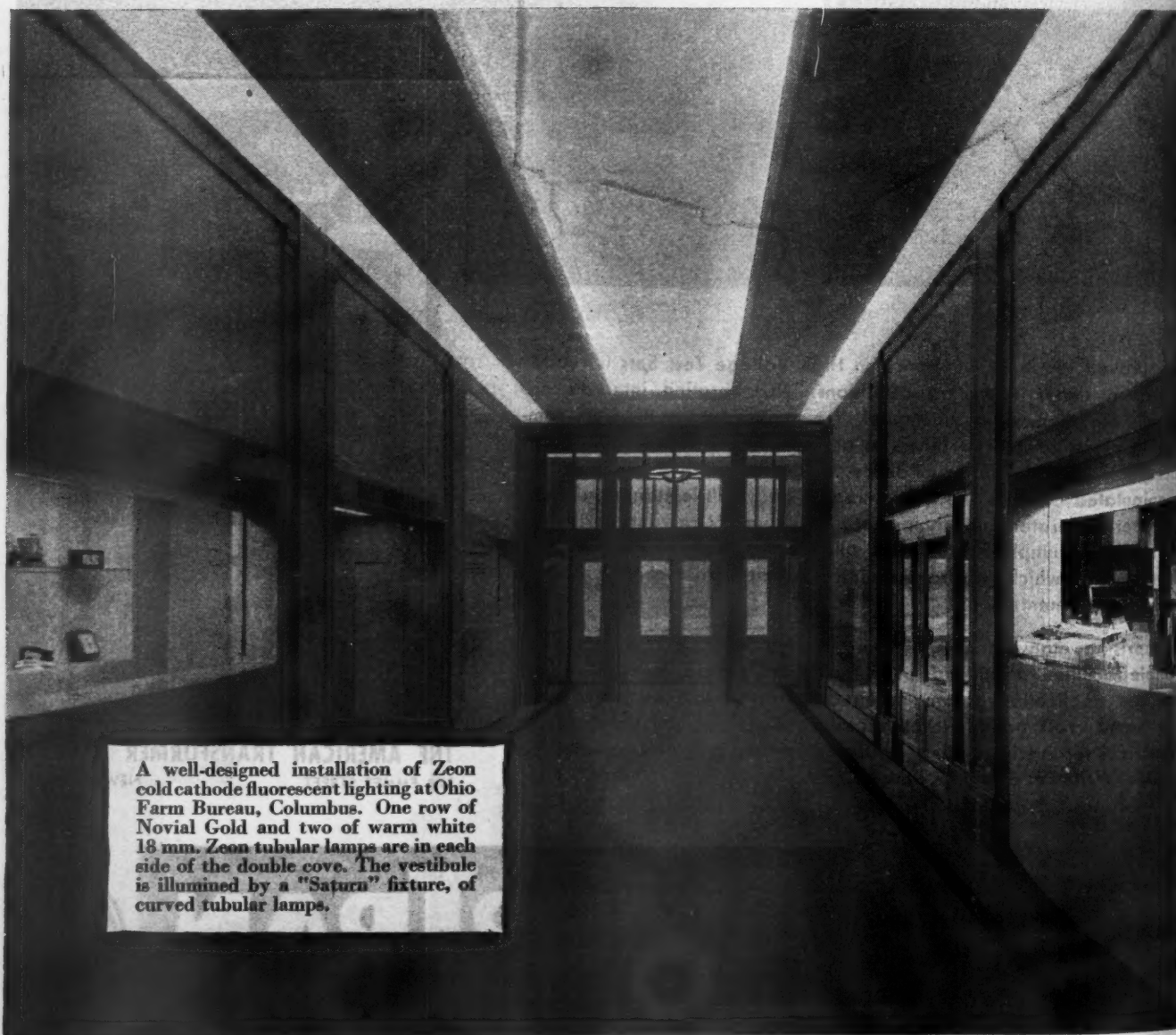
How to take
full advantage of
the economy...
long life...effective
illumination of.....

Cold Cathode

Why COLD Cathode?

Long lamp life and lower maintenance costs are always desirable, sometimes supremely important. These are outstanding characteristics of Zeon cold cathode fluorescent lighting. That is why many architects, builders, contractors,

and managers insist on cold cathode fluorescent particularly when maintenance man-power must be conserved. Notice the list shown below; if you have not used Zeon lighting get details now from Federal Electric Company, Inc.



A well-designed installation of Zeon cold cathode fluorescent lighting at Ohio Farm Bureau, Columbus. One row of Novial Gold and two of warm white 18 mm. Zeon tubular lamps are in each side of the double cove. The vestibule is illumined by a "Saturn" fixture, of curved tubular lamps.

Fluorescent Lighting



LONGER LAMP LIFE

means fewer changes of lamps, less inconvenience and trouble with burned-out lamps.

LOWER MAINTENANCE COST

because lamps seldom need replacing; fewer auxiliaries, less wiring to make trouble.

INSTANT STARTING

without overload; cold cathode lamps start instantly on their operating voltage.

CONSTANT LIGHT FLOW

with no flicker; minimum of shadow; maximum of even, diffused illumination.

FEWER AUXILIARIES

Only transformer and minimum of wiring are needed with cold cathode lighting.

GREATER FLEXIBILITY

in shapes, sizes, colors, and output; standard units or custom-built installations.

The many advantages which cold cathode lighting offers can be best realized when the lighting is tailored specifically for the area to be illumined. That is one of the advantages Zeon cold cathode fluorescent lighting offers. It is available both in special design, lengths, sizes and shapes and a variety of colors; and in standard size tubular lamp units.

Many locations require a high level of glareless, shadowless lighting. This can be done with Zeon standard units or with long lines of tubular lamps. Either of these can be supplied and installed by your electrical contractor. In other locations, illumination may be subordinated to decorative effects. Such installations are especially effective in hotels, theaters, stores and shops, where straight or curved units and various colors may be required.

To meet these special requirements, Zeon cold cathode lighting can be tailored for you by Federal Electric Company, Inc. and installed by your contractor under the supervision of your architect.

SEND US DETAILS OF YOUR PROBLEMS

Federal Electric Company, Inc. has wide experience in the manufacture, installation, and operation of standard and custom-built lighting systems. Its experience and that of its engineers may be valuable to you. If you will send us details of your lighting problems we will be glad to help you solve them. Write us at 225 North Michigan Ave.; Chicago 1, or 8700 South State Street, Chicago 19, Illinois; or call any of the offices listed below.

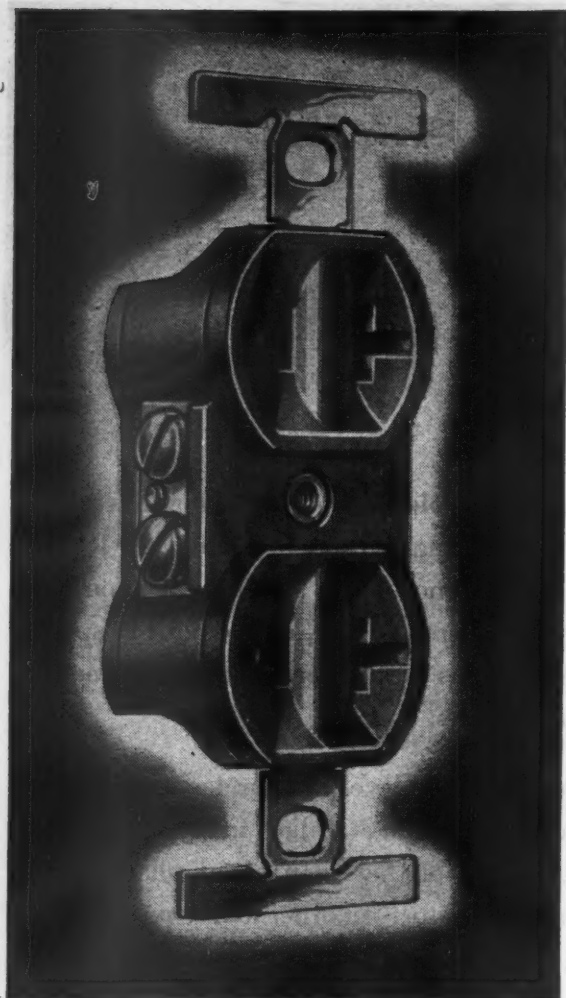


FEDERAL ELECTRIC COMPANY, INC.

8700 SOUTH STATE STREET, CHICAGO 19, ILLINOIS • TELEPHONE VINCENNES 5300
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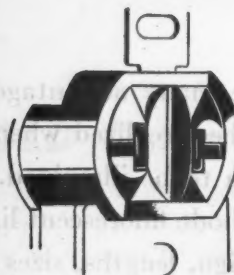
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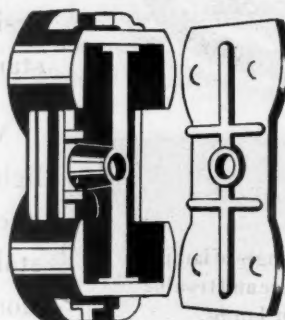


DUPLEX RECEPTACLE

built for service



EASY-TO-FIND SLOTS for effortless insertion of double "T," parallel, tandem or polarized-bladed plug caps.



HEAVY-MOLDED BAKELITE body and back plate, strong and moisture proof; completely enclosed and insulated current-carrying parts.

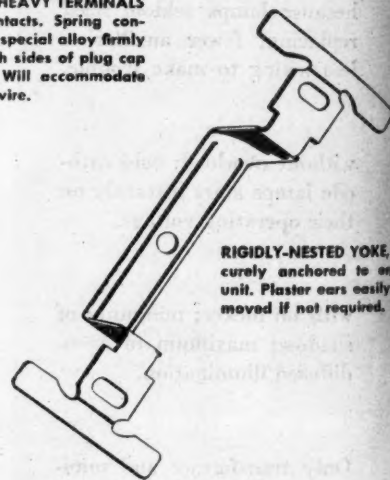
It pays to put in strong and enduring units like this Bryant duplex receptacle.

Quality materials, correct design and rugged construction make it a safe, long-service device.

Note the outstanding features illustrated and described at right.



EXTRA-HEAVY TERMINALS and contacts. Spring contacts of special alloy firmly grip both sides of plug cap blades. Will accommodate No. 10 wire.



RIGIDLY-NESTED YOKE, securely anchored to entire unit. Plaster ears easily removed if not required.

Specify Bryant devices from your electrical wholesaler



THE BRYANT ELECTRIC COMPANY
BRIDGEPORT, CONNECTICUT

NEW YORK • CHICAGO • SAN FRANCISCO • LOS ANGELES



BAKELITE INSULATING BARRIER, extended over wiring cavity, provides separation from materials on which mounted.

Saluting the GUTH* CADET



* THE FLUORESCENT LIGHTING
FIXTURE INSTALLED IN THE
UNITED STATES MILITARY
ACADEMY AT WEST POINT



Cadets marching to Guard Mount



Cadet Chapel from De Russy Loop



West Point from the Air



Colors during Battalion Parade

The GUTH CADET

West Point Cadets Study by the Light of GUTH "Cadets"

THE study-areas at West Point Military Academy are now lighted by the Guth CADET the new semi-indirect type luminaire.

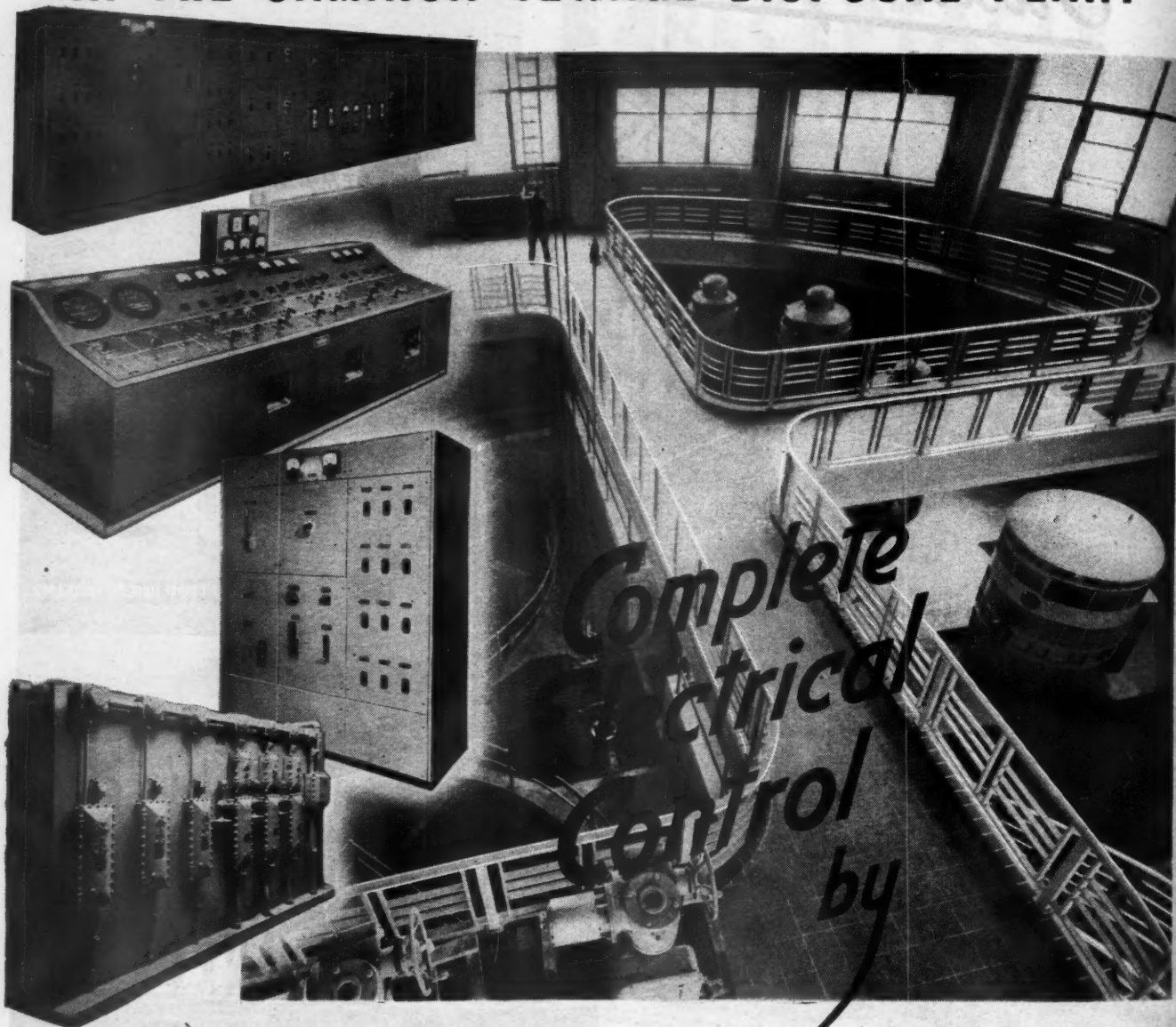
Forty-five Foot-Candles of uniform, glare-free, shadowless lighting is delivered on the study-desks. The illumination is evenly distributed throughout the area; there are no "Bright-spots"—all brightnesses are correlated. Reading visibility is excellent; writing with either pen or pencil is now effected without any direct or reflected glare. A 100% perfect seeing-light has been provided!

The new Guth CADET semi-indirect luminaire is now Commercially available. Write for details.



LIKE THE WEST POINT CADET, THE GUTH CADET IS
Smart in Appearance Efficient in Action Developed for Precision Dependable in Service

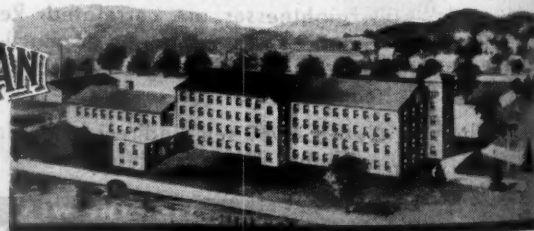
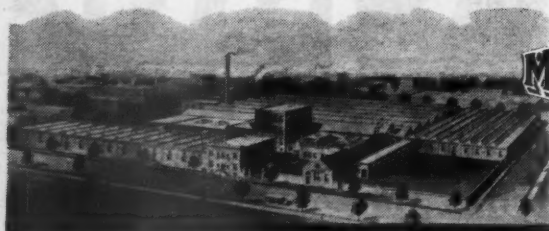
***FOUR* of the 18** METROPOLITAN SWITCHBOARDS IN THE JAMAICA SEWAGE DISPOSAL PLANT



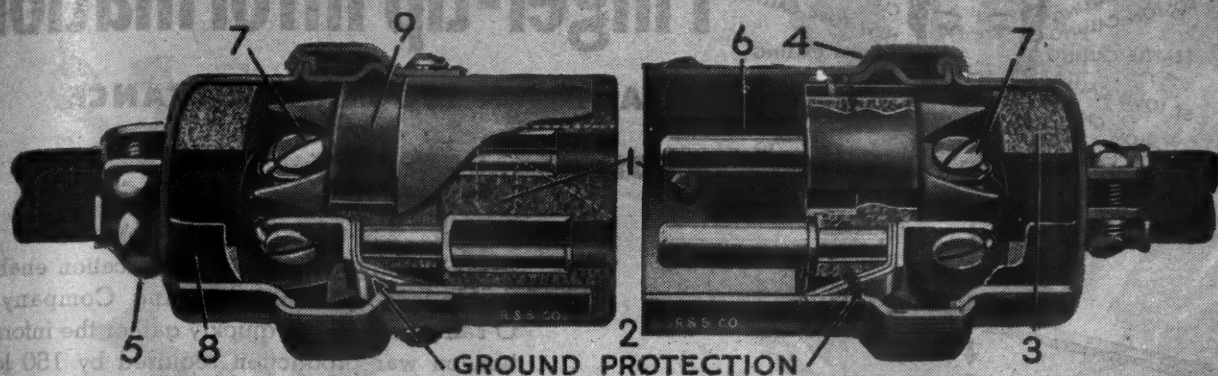
At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards	Motor Control Switchboards
Circuit Breaker Switchboards	Explosion-proof Switchboards
Dead Front Switchboards	Laboratory and Test Switchboards
Battery Charging Switchboards	Control Switchboards
Generator and Distribution Switchboards	

METROPOLITAN ELECTRIC MFG. CO.



GENERAL OFFICES: LONG ISLAND CITY, N. Y. FACTORIES: LONG ISLAND CITY, N. Y., & WEST WARREN, MASS.



EVER-LOK

Receptacles, Plugs and Cord Connectors

Ever-Lok is a simple automatic locking connection. It prevents accidental disconnection, is self aligning, well built and available in the form of receptacles and plugs for outlet and conduit boxes, surface and gang types, reverse and multiple circuit, weathertight and for cord connectors and also many special adaptations. The principal features shown above are—

1. Automatic Locking is positive—no chance of faulty contact. A twist of plug shell permits instant unlocking and withdrawal of plug.

2. Positive Grounding provides maximum protection to personnel and equipment.

3. Dust-proof—to exclude metal particles, dust, etc., from interiors of plugs and connectors.

4. Steel-Clad — Provides maximum protection. Light in weight, yet sturdy.

5. Cord Grip — Adjustable for wide

range of cable sizes. Prevents strains on connections and protects cable.

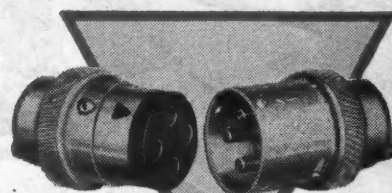
6. Contacts are machined, self-wiping and self-aligning.

7. Unit Assembly—Housing assembly plus interior assembly—easy wiring—only two pieces to handle. No screws to take out and lose.

8. Caps fibre-lined to prevent stray wire ends touching the shell.

9. Interiors—molded bakelite.

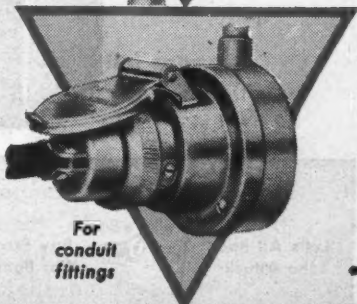
10. Polarized — Plugs cannot be inserted the wrong way.



The locking feature



In present conduit boxes as replacement units.



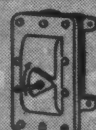
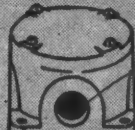
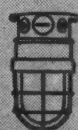
For conduit fittings

RUSSELL & STOLL COMPANY

125 BARCLAY STREET
NEW YORK 7, N. Y.

Ask your jobber or contractor about
R&S explosion-proof and water-proof
fixtures and fittings.

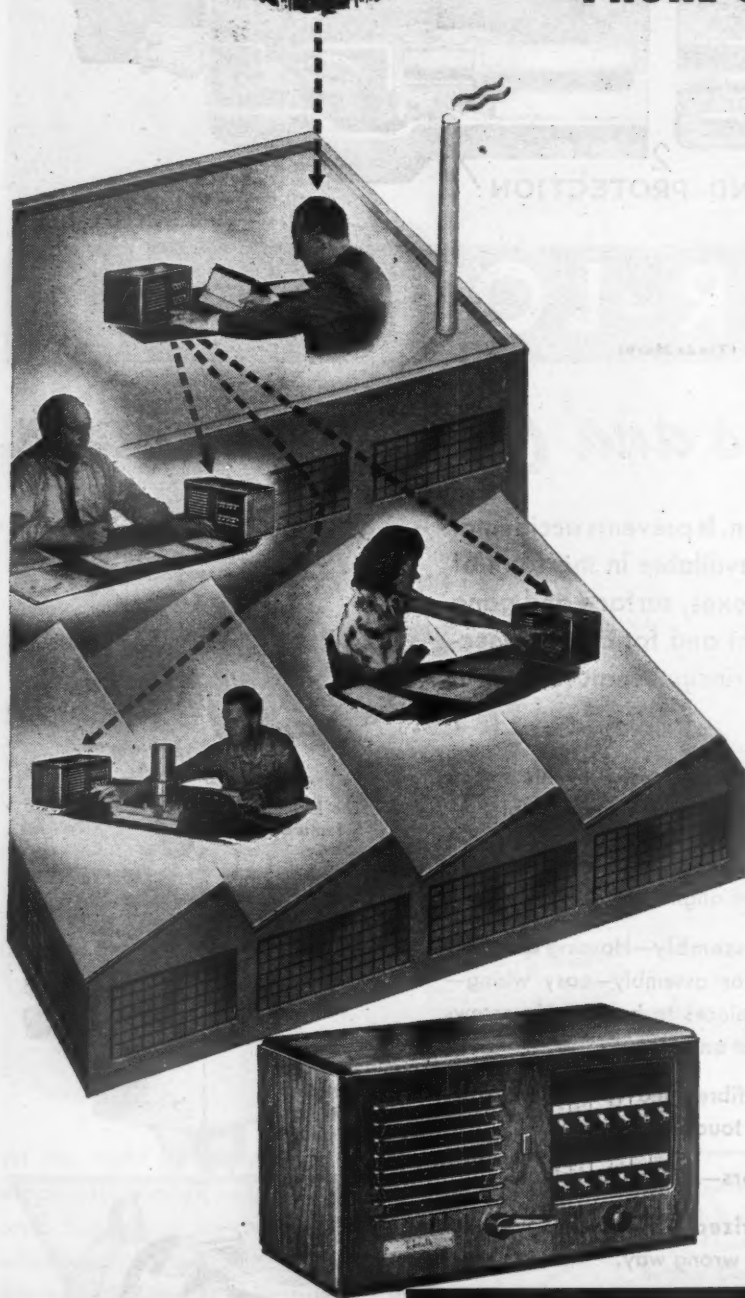
EXPLOSION-PROOF, WATER-TIGHT, AND EVER-LOK



LOS ANGELES CALLING
BOSTON CALLING
SEATTLE CALLING
ST. LOUIS CALLING
DETROIT CALLING
CLEVELAND CALLING
NEW YORK CALLING
OMAHA CALLING
MIAMI CALLING
CHICAGO CALLING

Finger-tip Information

**TO ANSWER 150 LONG DISTANCE
PHONE CALLS A DAY**



Teletalk Amplified Intercommunication enables the Independent Engineering Company of O'Fallon, Illinois, to quickly gather the information on war production required by 150 long distance telephone calls each day.

"Before installing Teletalk, time was lost in securing the required information relative to the shipment of parts or shipping time on equipment. With the Teletalk System, the desired information is at our finger tips," says Ray Christopher, vice-president.

Experience of this war-busy firm, located in a small Illinois town, is typical of the time savings afforded by Teletalk in hundreds of plants and offices everywhere.

There are dozens of spots for Teletalk Systems located right in your community. They almost sell themselves these days when you show the way in which they multiply the capacity of every key worker, can pay for themselves in a few months' time by the saving of time and energy.

Make Teletalk a profitable source of new revenue. Teletalk units are available to fit the needs of both large and small businesses. They are easy to install . . . operate from the electric light circuit. It will operate for years on a minimum of maintenance.

If you are not now handling Teletalk in your community, get in touch with us at once. Let us show you the profit-building possibilities it holds for you. Write us today.

Let's All Back
the Attack



Buy Extra
War Bonds

WEBSTER ELECTRIC
Teletalk
REG. U.S. PAT. OFFICE

WEBSTER ELECTRIC COMPANY
Racine, Wisconsin, U.S.A. • Established
1909. Export Dept. 13 E. 40th Street
New York 16, N.Y. Cable Address
"WEBEL" New York City

WEBSTER ELECTRIC

"Where Quality is a Responsibility and Fair Dealing an Obligation"

\$12,000 failure in a \$12 breaker



Could it just as well have been one of yours?

A motor-circuit fault occurred in a busy war-production plant, and the undersized circuit breaker went up in a burst of blue flame. Then, in an instant, the inadequate main circuit breakers failed as well—with a further dangerous blow-up that sent hot metal flying. Not until the power company's breaker tripped out was the short-circuit current brought to a halt. Production of the entire plant was crippled until repairs could be made. The loss exceeded \$12,000.

A failure like this—with its threat to production and danger to personnel—strikes more frequently than you think. It could occur tomorrow morning in hundreds of plants where electric circuits are being called upon to handle increased loads that they were never designed to carry. In such "shoestring" power distribution systems,

fuses and breakers often lack the capacity to interrupt the full rush of short-circuit current that can flow from the present source.

One new circuit breaker is no remedy. The interrupting capacity of every protective device, from entrance cable to machine, must be brought into line.

GENERAL  ELECTRIC

TO BE SURE of adequate interrupting capacity all through the plant, start making plans now to convert to a G-E load-center distribution system.

HOW A LOAD-C

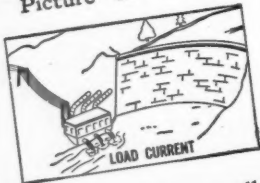
keeps short-circuit

NEED FOR ADEQUATE IC* OFTEN OVERLOOKED

CAPACITY OF SUPPLY
SOURCE "TAKES OVER" WHEN
SHORT CIRCUIT OCCURS

When a short circuit occurs, the flow of current is not limited by the size of the load—it may increase to several hundred times the load current. Thus the load carrying capacity of breakers or fuses is no measure of their adequacy as protective devices.

Picture the collapse

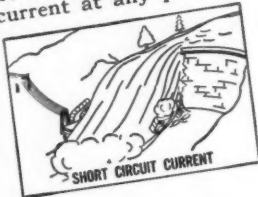


of a dam which normally supplies a penstock. The resultant damage is limited, not by the capacity of the penstock, but by the head and capacity of the reservoir. So it is with circuit-breaking equipment. Like the rush of water down the valley, too, the damage may be cumulative, so that normally adequate structures below are breached and broken one by one. Failure of an inadequate circuit-interrupting de-

*Interrupting Capacity

vice may cause a new, more serious short within the device itself as parts are welded under the intense heat.

CALCULATING SHORT-CIRCUIT CURRENT
Accurate methods now exist for calculating the available short-circuit current at any point in



a power system. These are applied in advance in specifying the co-ordinated elements that go together to make up a G-E load-center distribution system. A G-E application engineer can make sure that any special conditions within your plant are taken into account.

LOAD GROWTH A FACTOR

Systems which have been operating for years without a major short circuit often become increasingly vulnerable as load growth raises the capacity of the supply source, and as equipment weakens with age.

G-E LOAD-CENTER power distribution affords protection from the dangerous, production-crippling "blow ups" that can result from devices of inadequate interrupting capacity. What's more, the circuit protection for each load area *stays* adequate, despite expansion of your electric system to serve new areas—provided, of course, the system was properly planned originally. Each load-center substation is an individual "road-block" which isolates such short circuits as may occur. Additions to the co-ordinated system can be made without concern as to the interrupting capacity of devices in the localized secondary circuits (where transformers are not in parallel on the secondary side).

War plants equipped with load-center systems have established exceptional records for *uninterrupted* power usage. Now, they are finding that the flexibility of their systems to meet plant changeovers is an equally great advantage.

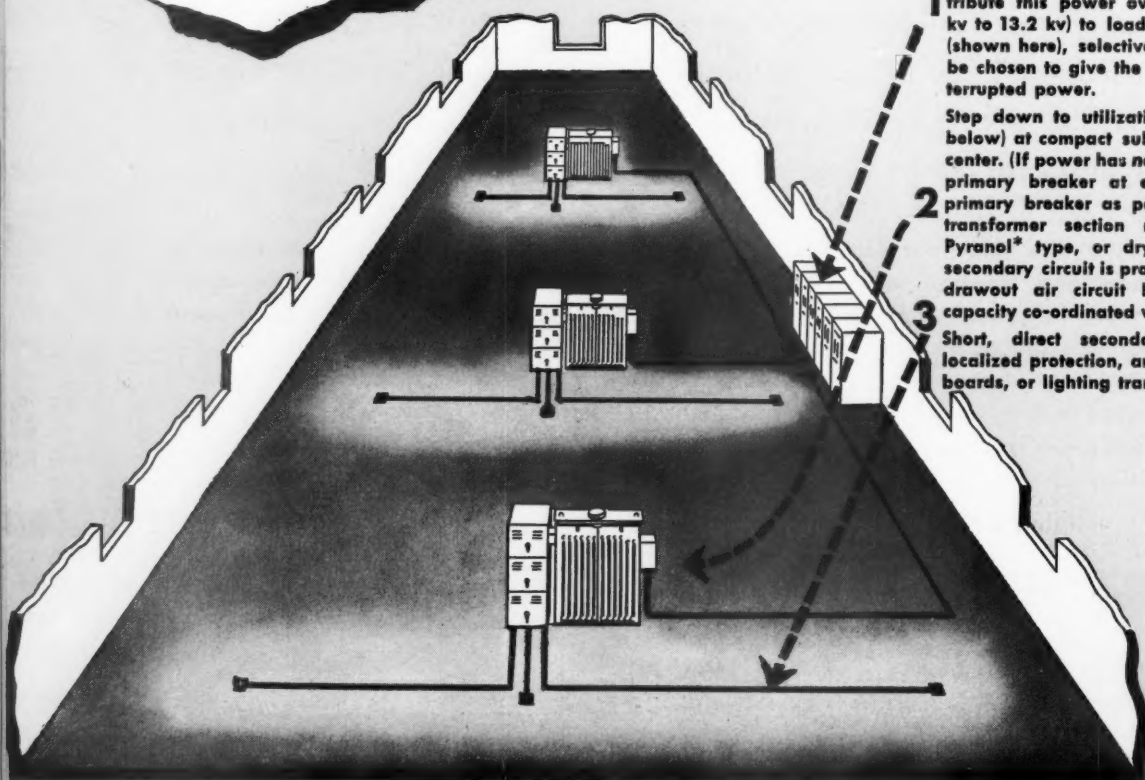
Before you install any new switchgear, or attempt to revamp outmoded power distribution circuits, switchboards, or substations—better investigate the performance records of G-E load-center installations. Just ask your local G-E representative.

Bring in your high-voltage power through a metal-clad distribution and metering panel (or master unit substation if power is purchased at 13.2 kv or above). From primary breakers, distribute this power over high-voltage lines (2.3 kv to 13.2 kv) to load-center substations. Radial (shown here), selective, or network systems can be chosen to give the desired assurance of uninterrupted power.

Step down to utilization voltage (600 volts or below) at compact substations right at the load center. (If power has not come through metal-clad primary breaker at entrance panel, include a primary breaker as part of the substation.) The transformer section may be noninflammable Pyranol* type, or dry type if preferred. Each secondary circuit is protected by a metal-enclosed drawout air circuit breaker, with interrupting capacity co-ordinated with the transformer rating.

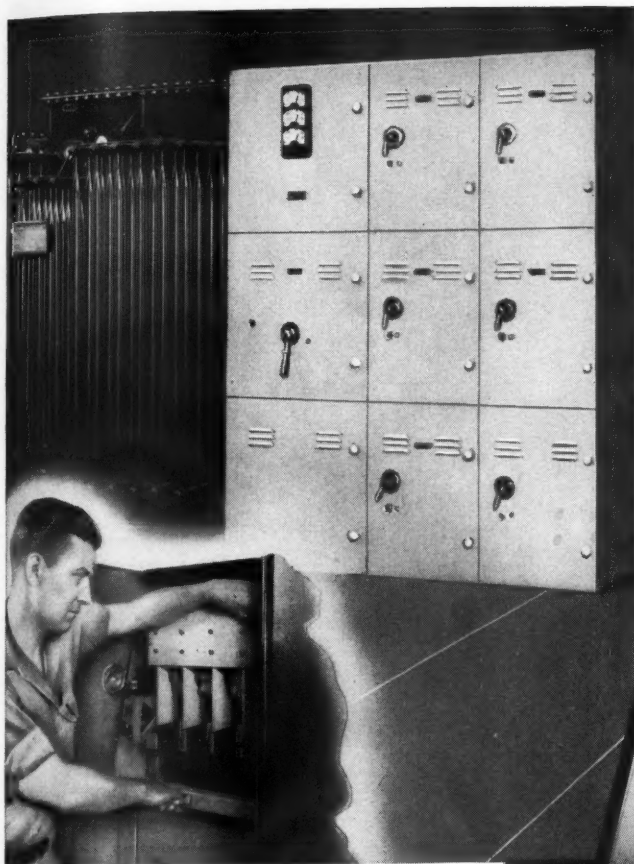
Short, direct secondary feeders, each with localized protection, are run to equipment, panel boards, or lighting transformers.

*Reg. U.S. Pat. Off.



D-CENTER POWER SYSTEM

it currents from ***RUNNING WILD***



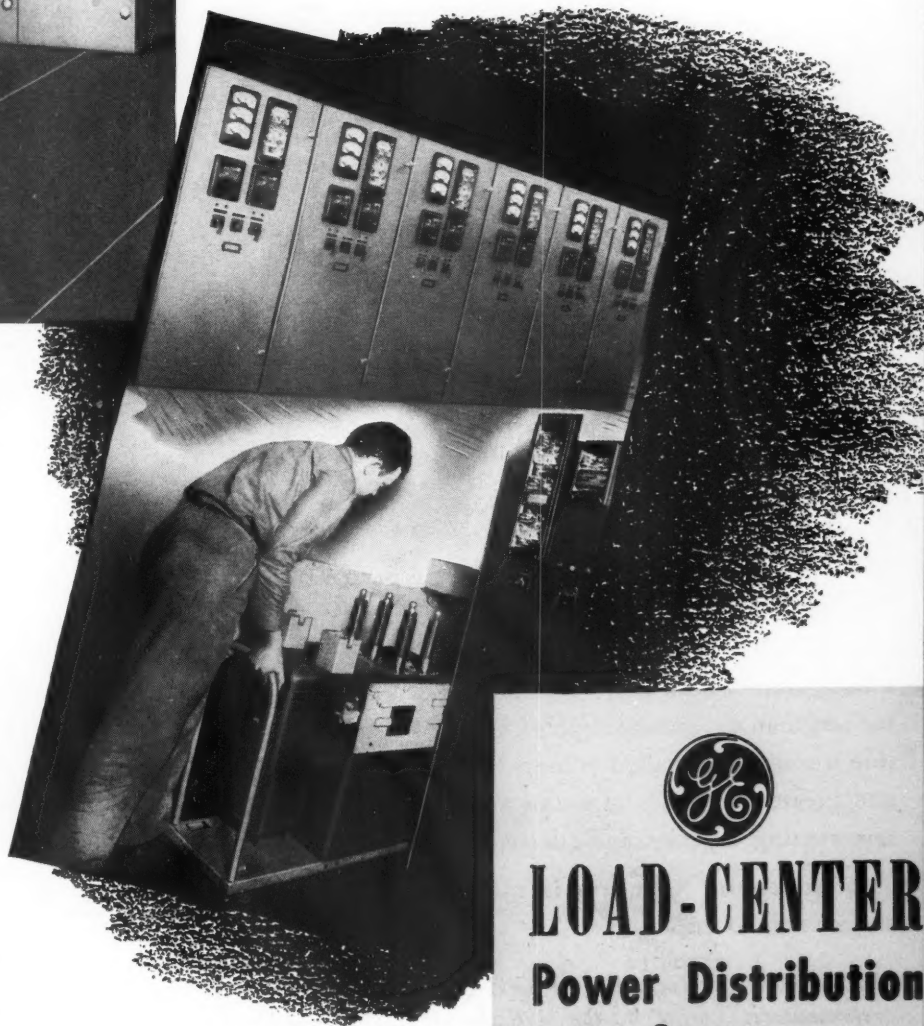
Short-circuit protection of primary plant circuits is best assured by metal-clad switchgear, with magne-blast air circuit breakers, located at the load-center substation, at a central distributing point, or as part of a master unit substation.

Breakers, buses, and other circuit components are completely enclosed within grounded steel compartments that go together to form fully co-ordinated, factory-assembled units. The breakers are of the easily removable and interchangeable type.

Expansion of your power requirements can be handled by adding units electrically matched to the original installation.

Key points in load-center power protection are the G-E air circuit breakers, which localize faults in the low-voltage feeder circuits. Their interrupting capacities are *always* matched to the capacity of the transformer.

The draw-out feature simplifies inspection. Interchangeability of breakers cuts circuit-outage time for servicing. Safety interlocks automatically open the breaker upon any attempt to insert or withdraw the breaker while it is in the closed position.

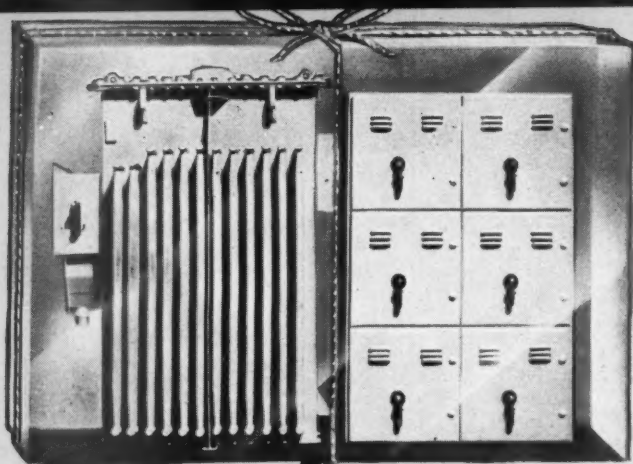


LOAD-CENTER
Power Distribution
Systems

Buy all the BONDS you can—and keep all you buy

GENERAL  ELECTRIC

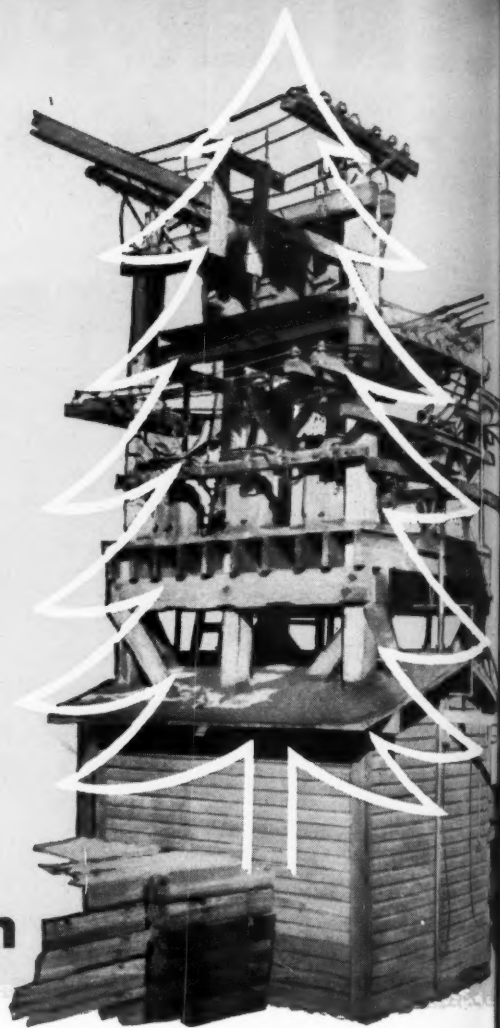
302-32-5900



Packaged Successor

to

Christmas-tree Design



● G-E UNIT SUBSTATION DOUBLES CAPACITY AT LESS THAN REVAMPING COST

When this lumber mill's load increased, the management first considered revamping a piecemeal-built, wooden-tower substation to double its capacity. This meant making room for three 100-kva single-phase transformers and the necessary accessories, although the old substation impeded yard traffic as it was.

A G-E application engineer reviewed the plans. He showed that a new, factory-built unit substation of 300 kva could be installed for less than the revamping cost. Using a Pyranol transformer section it could be installed indoors, with shorter low-voltage feeders, and greater assurance of uninterrupted service. It meant adequate interrupting capacity, and adequate provision for load growth.

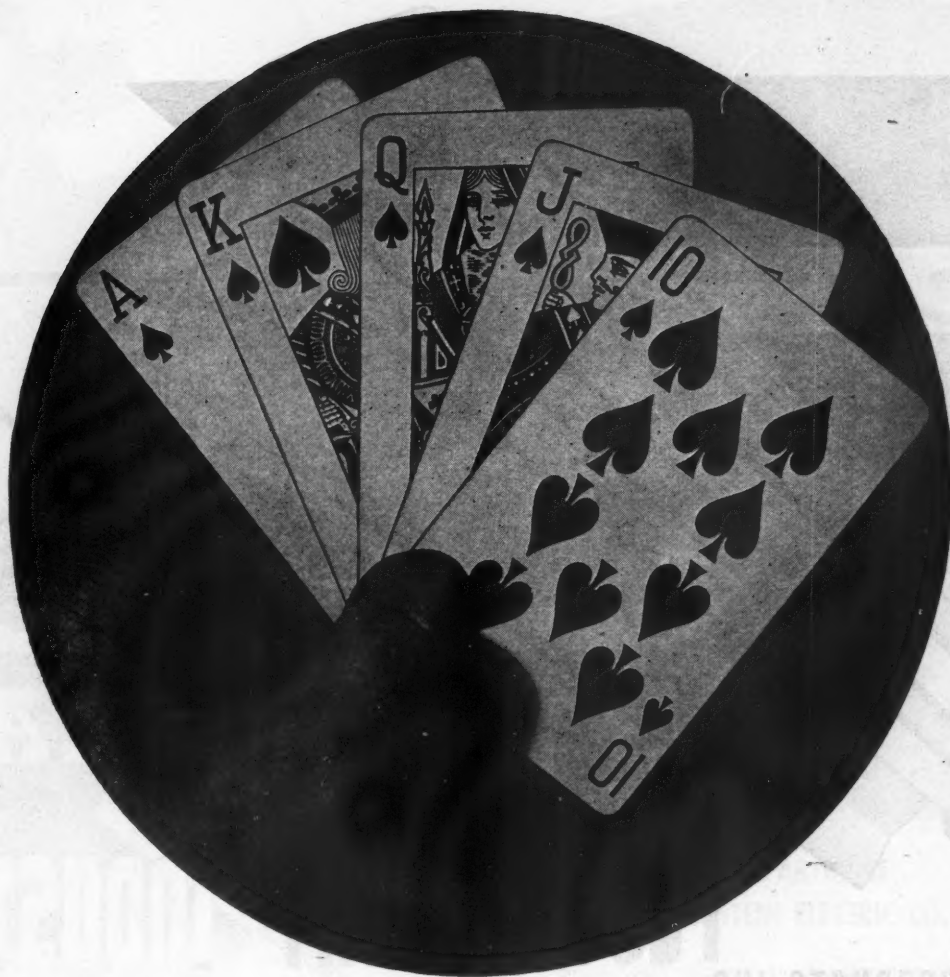
Latest report: "Company is enthusiastic about unit substations and intends to install more."

For complete information on G-E unit substations, see our local representative, or write for Bulletin GEA-3758. General Electric Company, Schenectady 5, N. Y.

GENERAL  ELECTRIC

UNIT SUBSTATION

- ✓ — Safely at home anywhere in the plant, thanks to Pyranol or dry-type transformer.
- ✓ — Interrupting capacity coordinated with transformer rating. Fully metal-enclosed switchgear.
- ✓ — Built to standard designs by repetitive manufacture. Easy to install and maintain.



TOPS EVERYTHING

The Shawmut Shur-Lag Fuse is made to protect, while giving the fullest range of safe, uninterrupted circuit operation. Experienced engineering, scrupulous manufacture, and unusual patented features account for its positive performance, full security, simple and rugged construction, and long operative life. And besides, its renewal with the Shur-Lag Link is unequalled for ease, convenience, and speed.

Specify Shur-Lag and dismiss the fuse question, as so many have.



THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

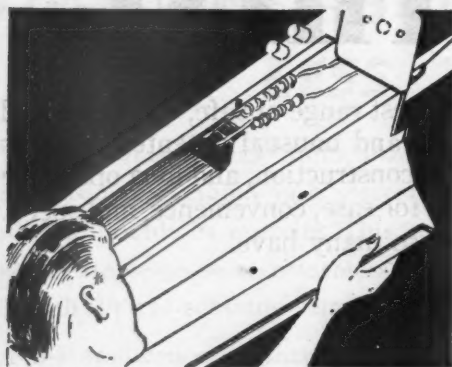
FUSE MAKERS



SINCE 1893



**LIGHTING PRODUCTS INC.
ONE MAN INSTALLATION**



Hinged Reflector simplifies fixture hanging to one man where the ordinary fixture requires two. The housing which contains all electrical equipment, is first hung in the desired position. Reflector is then hooked on housing as shown in above illustration. This relieves person of holding up the entire weight of Metal Reflector. When units are mounted in continuous runs any unit Reflector may be swung independently of the others.

With Labor Saving Installation and Maintenance Features . . .

Engineered and manufactured to more than meet the most rigid lighting specifications, the new all-metal-all-feature No. 125-A with conventional type ballasts and the No. 130-A furnished with instant start ballasts, combine design features not to be found in any other industrial fluorescent fixture.

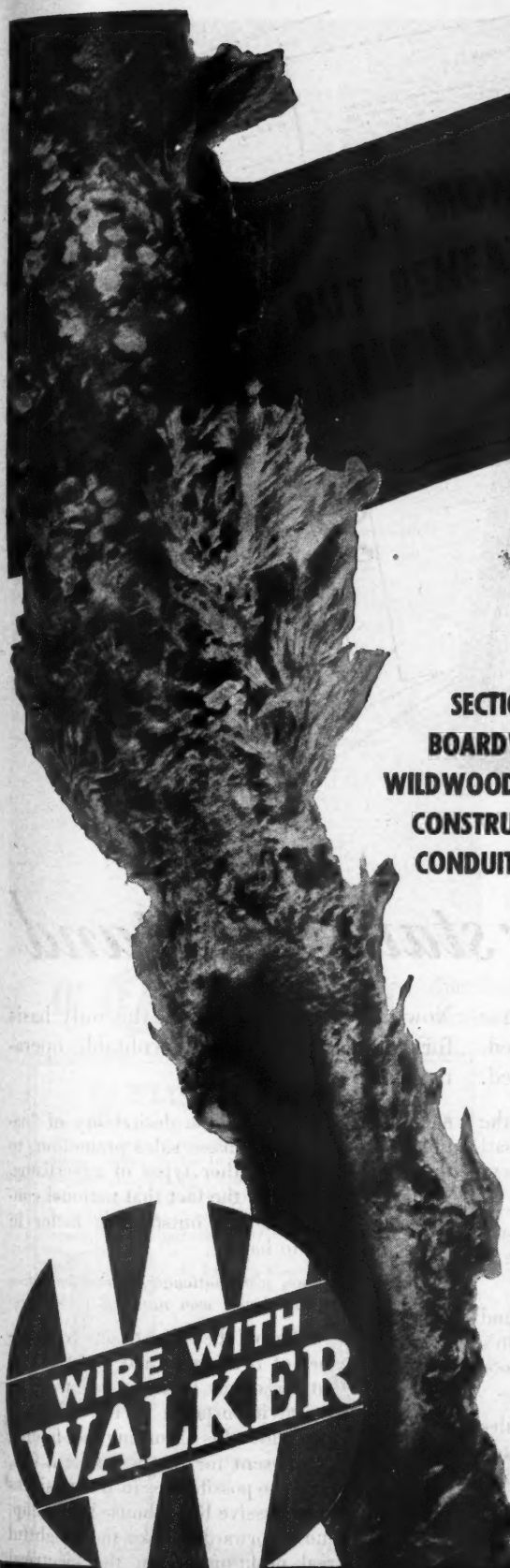
Not only are these units outstanding in utility design—but are constructed to give longer life and to deliver more high intensity effective illumination to the lighting plane.

Following are the features that makes these leading luminaires—

Patented "One Man Installation" — Designed for any type of hanging, including continuous runs—Metal drop ends for socket protection — Separate starters on conventional type units — Third lamp may be added later on two lamp units—Knockouts in ends for pull chain switches—Twice fired baked enamel reflectors—All units die formed and electrically welded—Underwriters approved.

The Instant Start Series No. 130-A can be operated on uneven voltages and at low temperatures. This type of fixture requires no starters and turns on and off like an incandescent fixture. Its transformer is guaranteed for a full year against defects.

**LIGHTING PRODUCTS, INC.
HIGHLAND PARK • ILLINOIS**



**SECTION OF
BOARDWALK,
WILDWOOD, N. J.**



**CONSTRUCTED BY CITY ENGINEERING DEPARTMENT . . . THE DUALCOTE
CONDUIT WAS DISTRIBUTED BY BORSTEIN ELECTRIC CO., CAMDEN, N. J.**

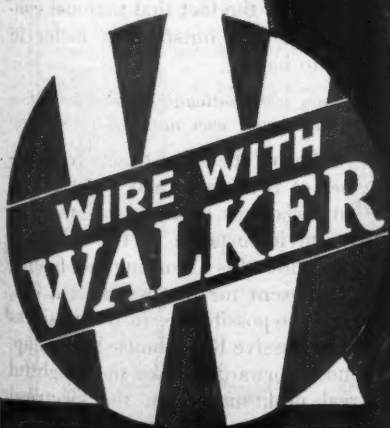
Before deciding upon what conduit to use for the boardwalk at Wildwood, New Jersey, the city engineer wanted to be sure that it would resist corrosion from salt water. He drove a section of DUALCOTE into the sand offshore leaving one end exposed to every high tide. It was left there for 14 months. The result was the barnacle encrusted oddity pictured here. But when the barnacles were scraped away the DUALCOTE finish was still intact, and as "good as new."

Naturally, after passing this severe test, DUALCOTE conduit was used exclusively for the wiring circuits. And they will be serving dependably as long as the boardwalk stands. The engineer who made this test and specified DUALCOTE is Mr. J. E. Orwell, City Electrician of Wildwood.

DUALCOTE GIVES DOUBLE PROTECTION

DUALCOTE is able to stand up strong under such severe punishment because it is protected by a combination of two resistant coatings. First, by the Walkerizing Process, a layer of zinc is fused into the inside and outside walls of the conduit—and so uniformly that even the threads are protected. Being actually alloyed with the steel, the zinc coating will not crack or flake when bent. To the outer zinc coating, a second coating is added—a new material, which prevents salt water and strong chemicals from eroding the underlying protection.

When wartime restrictions are lifted, DUALCOTE will again be ready to defy corrosion in chemical plants, refineries, dye houses, mines, mills, and other installations. In the meantime, it will pay you to learn more about DUALCOTE. Ask your distributor about prices and deliveries. For further information, write to WALKER BROS., Conshohocken, Pa.





The Rittenhouse Report

A flood of facts

PART 2

The Wholesaler states his stand

Today, as the results of the Rittenhouse Survey of the wholesale field are tabulated, many astonishing facts are being revealed.

FACT 1—76% of the electrical wholesalers of the Nation handled electric door chimes before Pearl Harbor. In actual figures, this would represent 1377 wholesalers, out of a grand total of 1812.

FACT 2—Of the wholesalers who previously have not handled chimes, 46% state that they will be in the business as soon as chimes are available.

FACT 3—From the figures contained in Fact 1 and 2 it may be deduced that 87% of the Nation's electrical appliance wholesalers will handle door chimes when production is resumed.

FACT 4—1173 wholesalers agree that future sales volume will be substantially above that of top year, 1941. Highest estimate of annual dollar volume was pegged at \$50,000 a year.

FACT 5—Largest actual dollar volume reported by a wholesaler was \$25,000, this covering chime business in 1941.

Now you may have them—the only basis for sound planning and profitable operation. Here are a few:

FACT 6—65.5% stressed the desirability of *national advertising and basic sales promotion, to the exclusion of all other types of advertising. This clearly points up the fact that national consumer acceptance is the outstanding factor in choice of brand to handle.

**Rittenhouse Chimes were nationally advertised before Pearl Harbor; Rittenhouse won national acceptance.*

These are but a few of the salient facts from the survey. The net of it all is to add proof to the conviction that the chime business has assumed a position of real importance in the electrical appliance field. Follow this absorbing fact-finding activity. It will present for the first time a full, factual picture of the possibilities in this business for you. Under aggressive Rittenhouse leadership, chimes now move forward to take their rightful position as real profit-makers in the electrical appliance field.

Next comes Part 3—the retailer's view—to be followed by the consumer report, presenting the cross-section opinion of 77 million people on chimes.

The A. E. Rittenhouse Company, Inc.
Honeoye Falls, New York

Rittenhouse

TOMORROW'S BETTER DOOR CHIMES

Electrical Contracting, October 1944



CHANGING the PLANT LAYOUT?

IF **FA** BUSDUCT

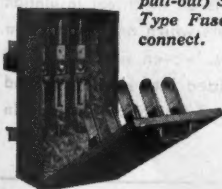
distribution for light and power is already installed, it will be a simple matter to adjust it to new requirements. It is practically 100% recoverable.

FA PLUGIN DEVICES

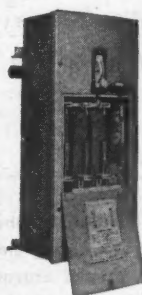
The **FA** Plugin Devices can be arranged to go on either or both sides of the Plugin **FA** Busduct, and each Plugin device is supported by independent fastenings. All **FA** Plugin Devices are equipped with proper capacity of rugged compression type bus bar connectors. They are made in three types. See illustrations below:



At left: **FA** Circuit Breaker Type.



Below: **FA** Klampswitchfuz (hinged type pull-out) Safety Type Fuse Disconnect.



Above: **FA** Shutoffbrak (operating Switch) with Kamklamp Fuse Holders.

Or, consider the conveniences and economies of this modern system in new planning... Feeder **FA** Busduct is ideal for large capacity connections between generators (or transformer station) and main switchboard, and between the latter and the feeder distribution system to the various parts of the building... Plugin **FA** Busduct affords great flexibility for machine layout. The plugin outlets spaced on 12-inch centers, make it possible to locate machines at any desired position, and to plug in quickly at the most convenient outlet—with minimum loss of production hours... Both Feeder and Plugin types are made in standard 10-foot sections. Suitable

elbows, tees, cross connections, intermediate feed-in and feed-out boxes, end closures with surge discharge protectors, and reducing capacity sections, make it possible to fit **FA** Busduct to any desired arrangement. It is adaptable to any required position or location... Extensions may be made readily to existing systems, without disturbing them, and at minimum labor cost... Installation of **FA** Busduct is economical for small plants, as well as large.

Designed for 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum. Capacities in accordance with Limitation Order L-273.

Write for Bulletin 65

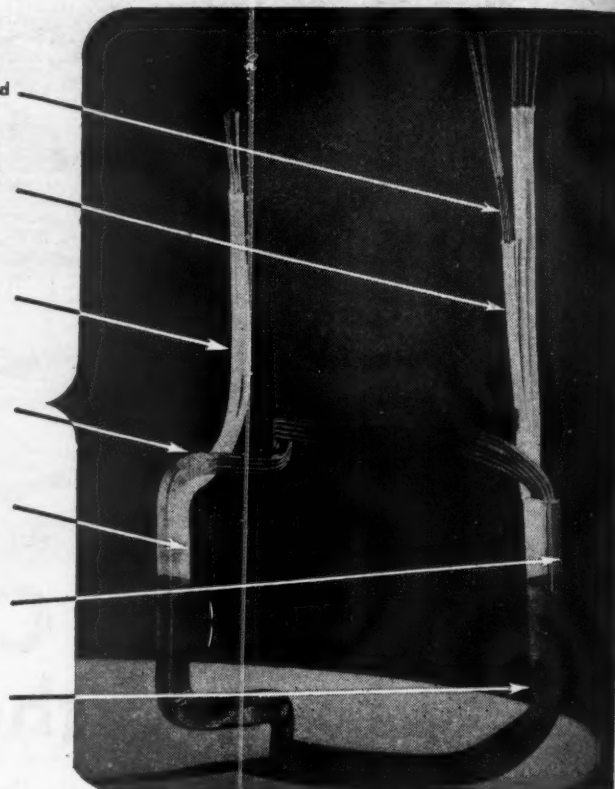
Also for name and address of nearest **FA** Sales-Engineer. Whether revamping the distribution system, or installing a new one, his long experience will be helpful to you. Frank Adam Electric Co., Box 357, St. Louis 3, Mo.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS

7 PLACES TO USE FIBERGLAS* in Motor Insulation...

On form-wound coils—
of any span
(round or rectangular wire)

1. Fiberglas multiple-wound yarn served on wire.
2. Fiberglas braided sleeving.
3. Fiberglas tape.
4. Varnished Fiberglas tape.
5. Fiberglas-mica combination.
6. Fiberglas base laminated material.
7. Fiberglas-impregnated tape.



Fiberglas is only a part—but an important part—of the finished insulation job. It furnishes a *stable base* for the varnish to cling to. If properly applied, Fiberglas *outlasts* any other material in this basic role—especially where severe heat, moisture and vibration conditions exist. Because it is inorganic, it makes possible *longer life* for the insulating varnish. Fiberglas does not shrink—from heat, age or any other cause. Hence, once it is applied, it forms a *dimensionally stable* base for the impregnating varnish. Since it does not shrink, windings do not tend to loosen, and hence coil insulation is not harmed by movement of one coil against another, or against stator iron.

It is not difficult to apply Fiberglas correctly—if consideration is given to Fiberglas characteristics. For example: Fiberglas tape “gives” very little (maximum of 3%). This produces a coil with an exceptionally “tight wrap”. But, on the other hand, care must be taken in wrapping

sections of coils that must be bent or twisted severely, otherwise the bending might tear or break the tape.

Fiberglas is rolling up new performance records every day in “tough” motor applications where even other inorganic insulating materials are comparatively short-lived . . . All forms of Fiberglas electrical insulation are available for immediate delivery. Ask your distributor or write Owens-Corning Fiberglas Corporation, 1856 Nicholas Building, Toledo 1, Ohio; in Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.

WHAT IS FIBERGLAS? Fiberglas is an electrical insulation made up of fine, strong glass fibers which are twisted into yarns and wrapped around wires, woven into tapes and cloths, imbedded in plastics, braided into sleeves, twisted into cords—to give all the forms of insulation required in electrical equipment.

FIBERGLAS ELECTRICAL INSULATIONS

*T. M. Reg. U. S. Pat. Off.



YARNS • TAPES • CORD • SLEEVING • CLOTH AND OTHER FORMS

ORDERS POURING IN!

Overwhelming TRADE ACCEPTANCE

FACTORY FACILITIES
ARE TAKING CARE OF THEM



Submitted to Underwriters' Laboratories Inc., for approval.



Submitted to Electrical Testing Laboratories, Inc., for certification.



Lloyd NEW "Automatic"

STARTER

Most practical and highest quality starter yet devised.
Locks out . . . Resets AUTOMATICALLY.
No need to do anything to the starter.
Positively cuts out deactivated, flickering, blinking lamps.
Automatically cuts off current to ballast and lamp.
Longer life for ballast because defective lamp is LOCKED OUT. Prevents overheating.
RED PLASTIC CAN — distinctive, lighter, stronger. Higher dielectric strength.
SEALED. No projecting lugs.
Life of the Lloyd AUTOMATIC Starter is many times greater than that of the average lamp.
Tested in production and before shipment to insure perfect performance.

Lloyd Policy Insures Quality

IN THE NEW
RED PLASTIC
CAN

LLOYD PRODUCTS COMPANY

Dep't. EC-10

PROVIDENCE 5, R.I.

Representatives in 23 Leading Cities. Export Office 13 E. 40th St., N. Y. C.

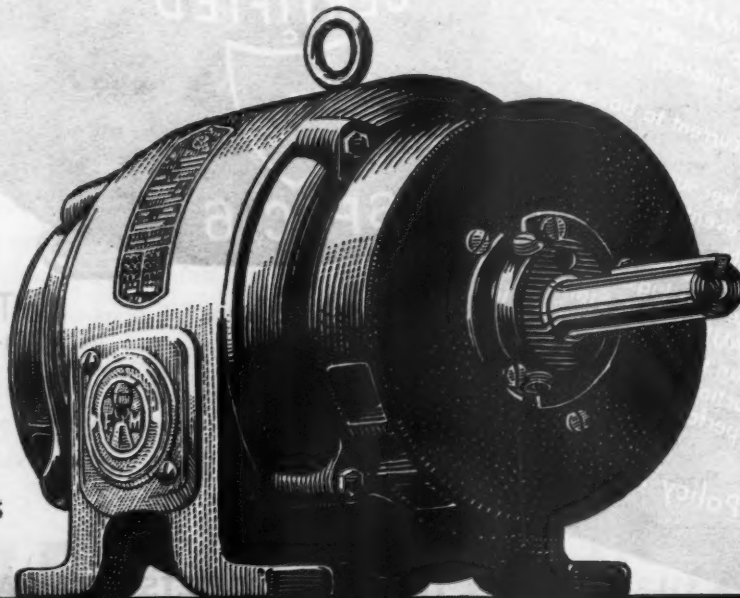
A name worth remembering!



FAIRBANKS-MORSE

After the war, the name Fairbanks-Morse will continue to mark performance-proved products only, as it has for 114 years.

No race to get civilian products onto the market early will tempt us to break this pledge.



Features of the New Fairbanks-Morse General-Purpose Motor

- It is a 40° C. motor.
- It is a protected motor.
- It has an optional conduit box assembly.
- It has cross-flow ventilation.
- It has ball bearings, sealed in and protected.
- It has the exclusive Fairbanks-Morse Copperspun Rotor.

**BUY MORE
WAR BONDS**

DIESEL LOCOMOTIVES • DIESEL ENGINES • GENERATORS • MOTORS • SCALES • PUMPS • STOKERS • RAILROAD AND FARM EQUIPMENT

FAIRBANKS, MORSE & CO., CHICAGO 5, ILLINOIS



"What goes on here?"

A FAIR question, thinks little Oswald, for his reputation as a host is at stake.

"Looks like we're serving *soup*—for dessert!" says he, worried about the end of a perfect party . . .

Naturally, his mother blames it all on the refrigerator. But she's wrong. The trouble really lies in the antiquated wiring circuits in the Bjones kitchen.

You see, everything but the kitchen stove is hooked onto the *same circuit* that serves the refrigerator!

As a result, the circuit is overloaded and all appliances connected to it operate ineffectively. The refrigerator motor, for example, fails to come up to proper speed and the protective device shuts it off to prevent damage to the

motor. Consequently, the refrigerator doesn't keep the ice cream hard.

Overload in home wiring also reduces lighting efficiency—slows down cooking—runs up the monthly electric bill.

• • •

The Westinghouse Better Homes Department was created to help improve home wiring practices—not only in the construction of 194X homes but in the modernization of existing homes, as well.

Now, while homes of the future are still in the planning stage, why not refer your *electrical problems* to our housing specialists who will gladly give you authentic information on such subjects as—

Selection of electrical equipment.

Arrangement of electrical equipment for proper sequence of operation.

Sizing of wiring, water supply, and drainage lines for electrical equipment.

Location of convenience outlets, lighting outlets and controls.



"Electrical Living in 194X" will help you explain the urgent need for "better wiring for better living" to prospects for home modernization and for new homes.

To get your free copy, write Better Homes Department (EC-104), Westinghouse Electric & Mfg. Co., Pittsburgh 30, Pa.

Westinghouse

Plants in 25 Cities

Offices Everywhere

TUNE IN: John Charles Thomas, Sunday 2:30, EWT, NBC . . . Ted Malone, Monday, Wednesday, Friday 10:15 pm, EWT, Blue Network

Electrical Contracting, October 1944

MEET THE DEMAND WITH

ILLINOIS

COMPLETELY INSULATED
ALL PORCELAIN WIRING SYSTEMS . . .

PORCELAIN CONFORMS TO THE NATIONAL ELECTRICAL CODE



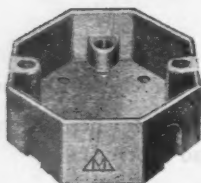
TOGGLE SWITCH
PLATE



Look for this
Trade Mark



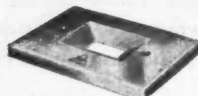
STANDARD TUBES



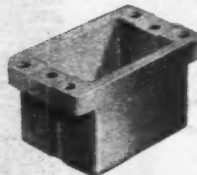
OUTLET BOXES AND
COVERS



STANDARD KNOBS



SWITCH BOXES
AND COVERS



CLEATS



DUPLEX
RECEPTACLE COVER

★ Contractors everywhere know that Porcelain in large quantities is available—that, therefore, they can do wiring jobs today with no let down in wiring quality—that they still can assure customers of permanency, dependability, and economy—that simplified modern installations are the result of the use of All Porcelain Wiring Systems.

This all means continued business for you—wiring goes right along—porcelain products are in demand. So, as those calls come to you for porcelain, be sure you are prepared with ILLINOIS PORCELAIN.

No vital materials go into the production of porcelain, materials do go into porcelain that make these systems durable—that are not affected by rust or corrosion—that make possible full safety—that make these systems valuable where there is dampness and fire hazard.

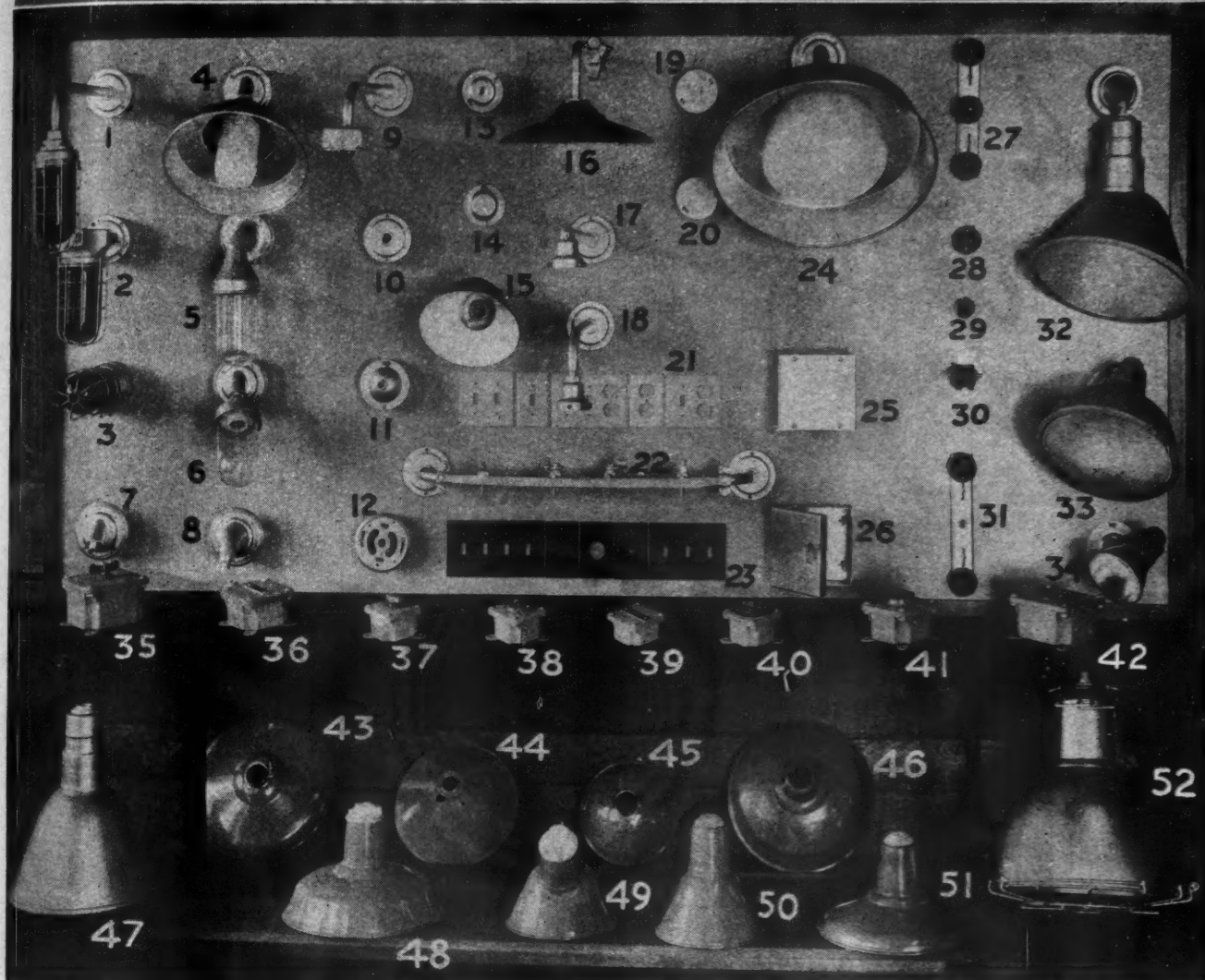
Illinois all porcelain wiring systems are adaptable to practically all wiring plans and layouts. They can be installed without grounding.

Illinois

ELECTRIC PORCELAIN CO.

MACOMB, ILLINOIS

52 OUT OF THE MANY GOOD REASONS FOR SPECIFYING **SPERO**



THE SPERO LINE OF DEPENDABLE ELECTRICAL PRODUCTS

Illustrated above are many, but not all, of the high quality products manufactured by SPERO, and available to contractors and dealers—through their wholesalers—from ONE RELIABLE SOURCE. When you specify SPERO, you are assured prompt delivery of dependable equipment, priced right. No need to waste time and money shopping around. These products are available NOW—either from stock or from current production.

Spero products pictured above include: Vapor Proof Fixtures (1-8), Outlet boxes and covers (9-14, 19 and 20) Diecast Sockets (17 and 18), Switch-plates (21 and 23), Ground Fittings and Clamps (22) Surface Cabinets and Pull Boxes (25 and 26) Wire Holders (27-31) Floodlighting Equipment (16, 24, 32-34), Navy 9-S Fittings and Fixtures (35-42), Reflectors (43-51) and Cargo Lights (52)

Consult your wholesaler or write us direct for full information on SPERO DEPENDABLE ELECTRICAL PRODUCTS.

Also—FULL RANGE OF INDUSTRIAL, COMMERCIAL AND RESIDENTIAL FLUORESCENTS



THE SPERO ELECTRIC CORPORATION

18222 LANKEN AVE. ★ CLEVELAND, OHIO

*A new milestone
in fixture progress*

FLUORESCENT

BASIC UNIT

At the gateway to the modern post-war world, Electro produces a miracle of fixture designing . . . a BASIC UNIT . . . one simple basic unit that bears promise of revolutionizing fluorescent fixture merchandising! You must include the BASIC UNIT in your plans for the immediate future. Write or wire for complete details.



Every ounce of the skill now being utilized by Electro in the manufacture of electrical devices such as this precision explosion-



proof aircraft motor for the armed forces has been utilized in the design and production of our new Lighting Equipment line.

ELECTRO

MANUFACTURING CO.

**2000 W. FULTON ST.
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Handy man



AROUND a busy plant or shop, a roll of U.S. Security Friction Tape is ready to come to the rescue on dozens of jobs that keep men and machines producing. Security is safe, sure and long-lasting. It's a handy man that pays its way many times over.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E. W. T. Carl Van Doren and a guest star present an interlude of historical significance.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

SERVING THROUGH SCIENCE



FOR SAFETY'S SAKE... USE CONDUIT (Full Weight Rigid Steel)

Planned Flexibility

THE contractors on this building were foresighted. They planned an electrical conduit system that would provide maximum flexibility for all future wiring needs --and they installed Youngstown BUCKEYE CONDUIT, as this picture shows.

For maximum flexibility in YOUR new post-war wiring jobs, or in jobs replacing wartime emergency wiring, install full-weight rigid steel conduit in such a way as to anticipate all possible future needs and changes.

Youngstown's BUCKEYE CONDUIT, installed in any building, provides a permanent, safe and easy method of increasing or varying wiring circuits at any future time. In fact, BUCKEYE CONDUIT outlasts the buildings in which it is used and gives complete protection against short circuiting or arcing from vibration, dirt, dust, moisture, or corrosion. In exposed spots its rigid, full-weight steel walls protect against crushing or other mechanical damage.

BUCKEYE CONDUIT is preferred by electrical contractors in all parts of the country for its unvarying quality and strength. It will soon be available at all distributors again.



Ask your distributor for
Youngstown Buckeye Conduit... Pipe and
Tubular Products... Sheets... Plates... Elec-
trolytic Tin Plate... Coke Tin Plate... Bars...
Rods... Wire... Nails... Tie Plates and Spikes.



YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND VOLOY STEELS

LAMPS CAN BE REPLACED WITHOUT REMOVING
GLASSWARE BALLASTS,



STARTERS REMOVABLE WITHOUT
DISTURBING OTHER PARTS
GLASS PANELS



REMOVABLE FOR CLEANING
WITHOUT TOOLS



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COMMERCIAL
FLUORESCENT
LUMINAIRES

ARE

EASY TO
MAINTAIN

New improved Westinghouse fluorescent luminaires are the answer to a maintenance man's dream—no "teardowns" every time a little replacement or cleaning is needed—no tight squeezes to replace starters or ballasts. And that's not all . . . four styles are available for individual or continuous strip installation . . . for suspension or ceiling mounting. Any style can be mounted and arranged to provide just the right level of cool, glareless lighting required for any office, drafting room . . . or similar application.

You'll be pleasantly surprised at the noticeable improvement in room appearance . . . and worker efficiency that results from lighting with new Westinghouse fluorescent luminaires. Get full details from your Westinghouse distributor today. Or write for B-3332. Westinghouse Electric & Mfg. Co., Dept. 7-N., East Pittsburgh, Pa.

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Westinghouse
PLANTS IN 25 CITIES OFFICES EVERYWHERE

Lighting Equipment

PORCELAIN AFFORDS COMPLETE

Protection

IN DAMP OR WET AS WELL AS DRY LOCATIONS ••

PORCELAIN PROTECTED WIRING SYSTEMS

PORCELAIN is a material that resists rust and corrosion, therefore these destructive agents that flourish in wet or damp locations need not be considered when porcelain wiring installations are made. This porcelain characteristic has been proved for more than 50 years from the first porcelain installations to the modern extensive layouts of today.

There is a factor contributing to rapid heat dissipation in Porcelain Protected Wiring Systems. When conductors are supported on porcelain insulators and

surrounded by air, the air dissipates the heat quickly. Among other features instantly recognized by industrial and commercial as well as residential customers are the short-proof and shock-proof qualities.

It's protection all the way for your customers with permanency, adequacy, and economy.

Get the benefits for yourself and customers the porcelain protected wiring systems make possible. Establish better customer relations as you make installations.

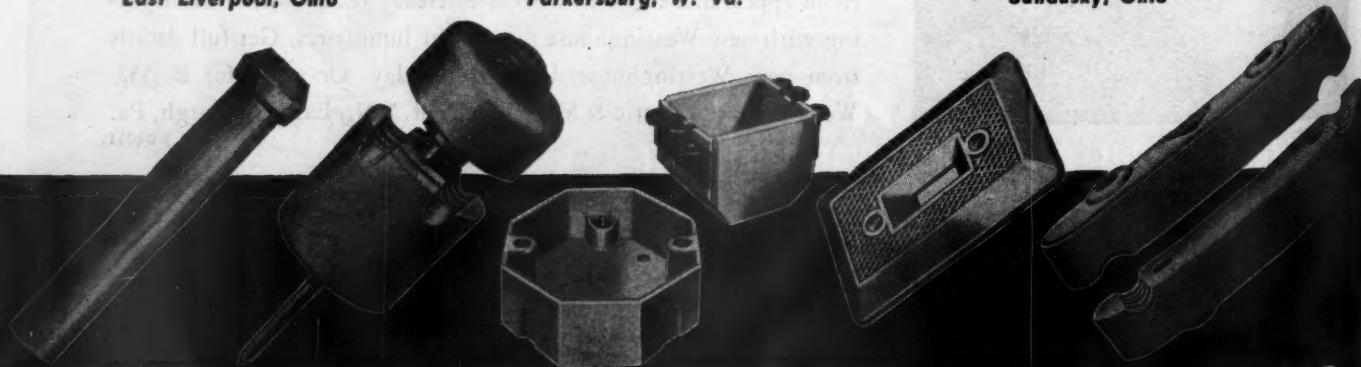
★ ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

★ PORCELAIN PRODUCTS, INCORPORATED
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★ SPECIALTY PORCELAIN WORKS
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★ SUPERIOR PORCELAIN COMPANY
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★ UNIVERSAL CLAY PRODUCTS COMPANY
Sandusky, Ohio



MODERN PORCELAIN PROTECTED WIRING SYSTEMS

The Economic Reconstruction of Europe

THE time is fast approaching when allied and enemy populations alike will demand a blueprint for the economic reconstruction of Europe. The peace plans following this World War will be written piecemeal, and by experts, at a series of continuing conferences, such as Hot Springs, Bretton Woods, Dumbarton Oaks and Quebec, each tracing a new pattern for negotiation and each dealing with a single, specific problem. In the drawing of these plans, the United States, as owner of more than half of the world's industrial capacity, controller of the only great credit reservoir, and possessor of the largest force of highly skilled technicians and management engineers, has heavy responsibilities which its industrial, financial, agricultural and labor leaders cannot evade.

★ ★ ★

Just what is the problem which the world's business leaders must help solve in Europe?

The best safeguard of peace is economic opportunity—a good chance for all peoples to raise their standard of living by their own ingenuity, foresight and industry.

Frustrated and disappointed peoples, who view the future with misgiving rather than hope, breed fanatical demagogues who seek to divert nations from their ills and disappointments by promising military glory and conquests.

Consequently, an important step in building a secure and lasting peace is to open the doors of opportunity to the peoples of Europe.

The greatest obstacle to opportunity in Europe has been economic nationalism.

The economic tradition of the Continent always has been highly nationalistic. The national feeling generated by the first World War, and the political autonomy conferred upon many peoples by the peace treaties, led to a great growth of economic restrictions. This trend was accentuated by the depression and by the military plans of the Fascists and Nazis. Hitler had to show his people they could be fed even if a blockade was imposed again. The inevitable result of these influences was to carry self-sufficiency to tragic extremes.

Economic nationalism holds down the standard of living of Europe in two ways:

1. It prevents the rise in most European countries of low-cost mass production.
2. It operates against an efficient geographical division of labor, preventing nations from doing what each can do best.

Great machines require great markets. One great machine of which the United States has many and Europe few is the continuous strip steel mill. At the outbreak of the war we had twenty-eight such mills of various sizes, England but one, and Continental Europe one. A building containing one of these machines is more than a quarter of a mile long and the minimum cost of the mill is almost \$25,000,000. Only the prospect of a mass market justifies production on this vast, but highly economic basis.

The wasteful geographical distribution of production is shown by the agricultural policies of Italy, France and Germany.

In the 1930's, when lard sold for less than 8¢ a lb. in the United States, it cost 32¢ a lb. in Germany. In Italy and Germany imports of wheat were banned and its production at home was heavily subsidized. By the middle of the 1930's, wheat sold for \$1.55 a bushel in France, \$1.97 in Czechoslovakia, \$2.29 in Germany, and \$2.47 in Italy. At the same time the United States and the other efficient world producers and exporters (Canada, Australia and Argentina) were restricting production and were unable to average more than about 75¢ a bushel for their wheat.

Economic unity in Europe must ultimately mean a freedom to trade not greatly different from what we have within the United States. Given economic unity and the large markets which go with it, efficient mass production will develop. With Europe receiving cheap supplies of such staple foods as wheat, pork, lard and dried fruits from overseas, European farmers can prosper by specializing in producing fresh foods—butter, cheese, eggs, fruits, vegetables.

Then European agriculture will be more prosperous producing its specialties, and our agriculture (and that of the other great efficient surplus-producing countries as well) will have greatly expanded markets for our staples.

With a cheaper food supply for Europe—yet one yielding a better price for our agriculture—European labor will live better. Labor now used uneconomically for agricultural production will be released for industry. With big machines and semi-automatic processes European labor can produce more steel, automobiles, furnaces, plumbing and electrical appliances to advance its standard of living in coming decades, as the United States has done in past decades.

A rising standard of living in Europe will bring

Europeans to view peace with optimism and hope. And world trade grows as confidence and prosperity widen.

★ ★ ★

How would a Europe which possesses economic unity appear to us on this side of the Atlantic?

It would be a prosperous Europe that would have strength in its advancing industries, but as the single great agricultural deficit area of the world, it would be dependent upon overseas supplies for vital agricultural staples. This dependence upon overseas agricultural supplies would be greatest for industrial Germany. Some people believe that a strong Europe would be a threat to world peace. More important, however, is the fact that a strong and prosperous Europe would not be a frustrated Europe. It would have found a way to achieve a rising standard of living. Furthermore, a prosperous Europe would, economically, be a dependent Europe because, although the European industrial worker would use more and cheaper food, he would have it only as long as he maintained the peace.

A prosperous Europe would be of special advantage to American agriculture (if we do not keep on pricing ourselves out of the market) and of great advantage to American industry.

The British policy of buying agricultural staples from abroad, for example, made her, a nation of only 45,000,000, the purchaser, in 1937, of \$250,000,000 of all kinds of agricultural products from the United States. In the same year the rest of Europe (exclusive of Russia), with a population of 325,000,000 purchased only \$300,000,000 of our agricultural products. But with more sensible organization of its agriculture, Europe could be expected to buy more than one billion dollars of agricultural products from us.

By far the greatest market for an expanded European industry will be Europe itself.

For American industry, there will be growing markets in Europe as industry expands. Experience shows that the trade between different highly industrialized areas is large. This country's biggest export markets have been with its keenest competitors—Britain, Canada, Japan, France and Germany.

Before the war, Europe, with two and one-half times the population of the United States, had only one-sixth as many automobiles.

If Europe (exclusive of Britain and Russia) were to motorize proportionately, it would need 75,000,000 automobiles. With normal depreciation this would ultimately mean 10,000,000 cars to be produced annually to replace worn out cars.

If one still wonders about the immense number of things Europe might produce for herself, let him calculate the highway expenditures, the filling and repair station businesses that must be equipped and maintained; and the doubling of the steel production that would be required to make the automobiles themselves and to reinforce with steel even a moderate amount of additional concrete highways.

Another example is the electrification of Europe. With two and one-half times our population Europe's

consumption of electrical energy would be 175 million electrical H.P., if the European worker were to have the advantage of as many H.P. as the American. Yet, just prior to the war, Europe's installed operating capacity was only about 40 per cent of this figure.

★ ★ ★

What has been sketched for Europe is actually much more nearly a page from the economic history of the United States than it is mere prophecy about a desirable future for a Europe at peace. But how can it be achieved? And what is our part to be in helping to bring it about?

Economic unity can be provided for the sovereign states of Western Europe by the peace treaty or treaties adopted at the end of the war. The provisions for securing economic unity in Europe should specifically cover:

1. Substantial freedom for persons and enterprises to do business anywhere in Europe.
2. Reasonably free movement throughout Europe of persons for employment, recreation and education.
3. Greatly increased freedom of trade:
 - a. Within Europe—through the application of a Europe-wide agreement reducing the tariffs among all European countries to a maximum of 10 or 15 per cent.
 - b. With the rest of the world—through reduction of European tariffs on goods bought from overseas. This would call for generally lower levels on manufactured goods, and for the removal (after a reasonable period of progressive reduction) of tariffs on all agricultural foodstuffs and most industrial raw materials.
4. A special currency provision requiring as nearly as practicable complete currency stabilization for all countries of Western Europe among each other.
5. Creation of an agency (with adequate revenues) through which all Europe-wide business and other affairs affected by these agreements would be administered for a minimum period of twenty-five years.

This would permit the economic unity of Europe to be substantially achieved. During this period, assistance in administering the provisions would be given by officials of the United Nations.

Near the end of such a period arrangements could be made for a vote in the European countries on whether or not to continue the "unification provisions." If the vote were in the negative, the United Nations would have proper warning that additional safeguards would be necessary to prevent war.

The suggestions made in this statement aim at securing economic unification of Europe and thereby promoting the possibilities of permanent peace in Europe.

The realization of these possibilities throughout the postwar years requires a freely expressed public opinion in Europe to guide all who share the responsibility for bringing peace to Europe and to the world.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

CONVENIENCE OUTLETS



ARROW all-purpose numbers for flush or surface work

These popular types of Convenience Outlets are available in brown and white "Ivorylite" plastics, as good in looks as they are good in quality. T-slot, with double side-contacts, self-adjusting.

No. 7724—Single, top-wired, Bakelite; No. 8264—Duplex, with 3 1/4" outlet box cover

(4" also supplied); No. 1911—Single, side-wired, Bakelite; No. 1913—Duplex, side-wired, Bakelite; No. 1913-I—Duplex, side-wired, Ivorylite; No. 7725-B—Duplex (4 Screws) top-wired, Bakelite. Just the group you need for carrying-on.

ARROW ELECTRIC DIVISION

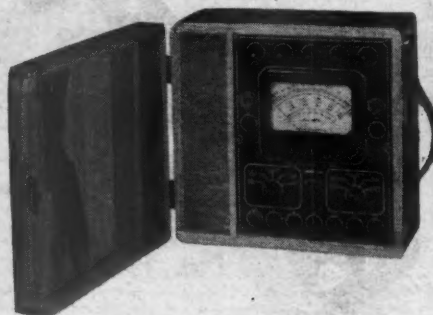
DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U.S.A.

ALL FOUR MODELS DESCRIBED ON THIS PAGE ARE NOW AVAILABLE FOR TEN-DAY DELIVERY ON PRIORITY OF AA-3 OR BETTER

THE MODEL 710

VOLT-OHM-MILLIAMMETER



* Sensitivity 1,000 ohms per volt on both A.C. and D.C. * Direct reading. * Completely self-contained. * No external source of current required.

SPECIFICATIONS:

6 D.C. VOLTAGE RANGES: 1 to 15/60/150/300/600/1500 Volts

6 A.C. VOLTAGE RANGES: 0 to 15/60/150/300/600/1500 Volts

7 D.C. CURRENT RANGES: 0 to 3/15/50/150 Milliampers

0 to 3/15/30 Amperes

A.C. CURRENT RANGE: 0 to 3 Amperes

5 RESISTANCE RANGES: 0 to 1,000/10,000/100,000 ohms

0 to 1 Megohm 0 to 10 Megohms

The MODEL 710 comes complete with cover, self-contained batteries, test leads and instructions. Size 6" x 10" x 10". Net Weight 11 pounds. Price.....

\$34.50

THE NEW MODEL 590

VOLTAGE TESTER



Reads Like A Thermometer! !
Automatically Indicates—

- Whether the voltage is 110, 220, 440 or 660 Volts.
- If the current is A.C. or D.C.
- If the appliance, motor, etc., connected in the line is "open".
- Which leg is "grounded".
- If the frequency is 25 or 60 cycles.
- If the fuse is "blown".
- When one side of an appliance or motor connected to the line under test is "grounded".
- Excessive leakage between a motor and a line.
- When a three phase motor is running erratically due to "blown" fuse.

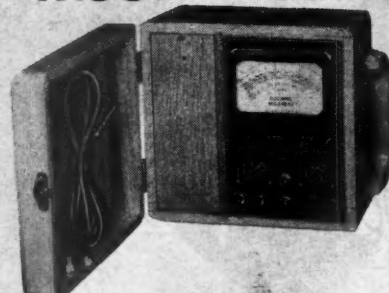
No meter, No switching, No tip jacks. To use: simply connect the needle pointed test prods across any line and this truly versatile instrument will instantly indicate the Voltage, frequency, type of Current, etc. Rugged, dependable and efficient, this amazing electric tester measures only 1 1/2" x 5" x 1 1/2" and weighs only 5 ounces. Unlike most electrical testing instruments which necessarily require a great amount of care, the Model 590 is designed for "bang around" maintenance work, and yet due to the unique design it compares favorably in sensitivity with expensive metered instruments in that it draws less than 1 Milliampere of current.

MODEL 590 comes housed in a beautiful hand-rubbed, wooden cabinet. Panel is of etched steel. Shipping weight 2 pounds. Complete with instructions. Only

\$5.85

THE MODEL 610-B

MEG-O-METER A NEW BATTERY-OPERATED INSULATION TESTER!!



INDICATES LEAKAGE UP TO 200 MEGOHMS AT A TEST POTENTIAL OF 500 VOLTS D.C.

NO HAND CRANKING:

The 500 Volt Test Potential is made instantly available by throwing the front panel toggle switch.

DIRECT READING:

All calibrations printed in large easy-to-read type enabling exact determination of leakages from 0 to 200 Megohms.

3 RESISTANCE RANGES:

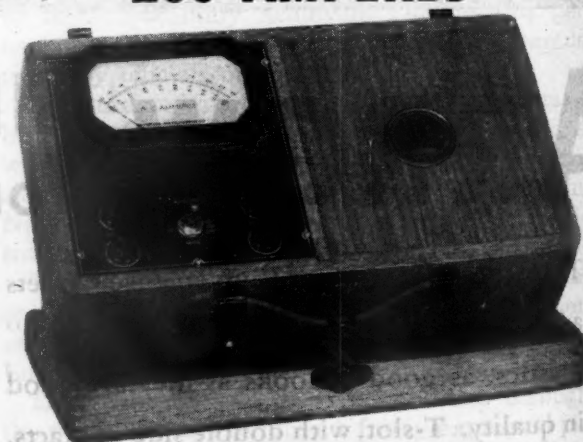
In addition to the 0 to 200 Megohm Range which is used for insulation testing, two additional lower ranges are provided, 0 to 20,000 Ohms and 0 to 2 Megohms.

Model 610-B comes housed in hand-rubbed, rugged Oak Cabinet, complete with cover, self-contained batteries, test leads and instructions. Only.....

\$62.50

THE MODEL 720

A.C. AMMETER MEASURES A.C. CURRENT UP TO 200 AMPERES



4 RANGES: 0 to 10/50/100/200 Amperes

The Model 720 combines the two most efficient methods of measuring A.C. Current. Heavy-duty binding posts on front panel used for measuring low currents to 50 Amperes. Built-in toroid transformer permits measurement of currents up to 200 Amperes without breaking line. Necessary only to insert either leg of the line through front panel core opening.

Model 720 comes housed in heavy-duty, leatherette covered cabinet, complete with cover and instructions. Size 13" x 7" x 4 1/2". Price.....

\$49.50

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Super FLEXIBILITY WELDING CABLE

FLEXIBLE AS A SERPENT



TOUGH-HIDED AS A RHINO



SHEDS DIRT & GREASE LIKE A DUCK'S BACK



NON-KINKING FOR SAFETY & EASY HANDLING

**COLLYER INSULATED WIRE COMPANY
PAWTUCKET, RHODE ISLAND**

COLLYER WELDING CABLE

THERE'S NEVER A DOUBT



**ABOUT THE FULL
FLOODLIGHTING
PROTECTION..**



SANGAMO TIME SWITCHES

WHERE THERE IS A NEED
FOR FLOODLIGHTING...
THERE IS A SALE FOR
AUTOMATIC
CONTROL



When a floodlighting installation is made the customer expects full protection through its use. He probably doesn't think at the moment that "on" and "off" timing errors can be made through human control. That simply means there is an opening for you to make another sale—that of SANGAMO TIME SWITCHES. All you have to do is explain that a SANGAMO TIME SWITCH never fails on the job—it switches lights on and off at exactly the right times as set. Tell the same story to present users of floodlighting who haven't this safeguard. You certainly have a profitable opportunity with this floodlighting protection.

WRITE FOR CATALOG

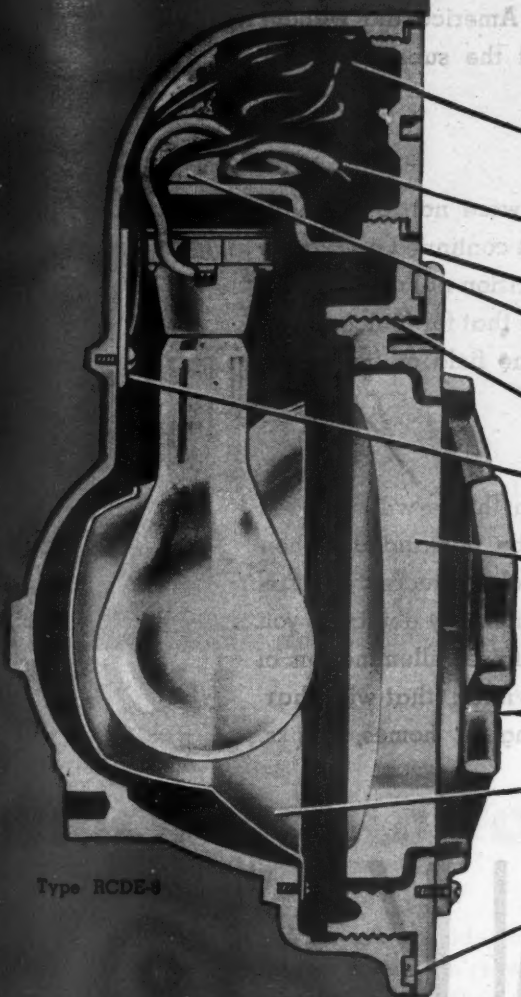
There are types to meet every protective lighting control need. The complete line includes Astronomic Dial, Synchronous Carry-Over, and Outdoor Time Switches. Form VSW2 Astronomic Dial Time Switch is shown above. Current interruptions up to 10 hours will not stop it nor affect its "on" and "off" settings.

SANGAMO ELECTRIC COMPANY **SPRINGFIELD ILLINOIS**

In hazardous locations where ordinary floodlights are unsafe because of the presence of explosive atmospheres, you can solve the problem by installing

CROUSE-HINDS

Explosion-Proof FLOODLIGHTS



Wiring chamber. Ample space for splicing. Easily accessible.

Asbestos covered leads. One wire is grounded to housing for safety circuit.

Cast aluminum or Feraloy (semi-steel) housing.

Factory sealed with sealing compound between wiring chamber and lamp housing. External seals unnecessary.

Flame tight threaded covers.

Adjustable receptacle bracket permits the use of 100, 150 and 200-watt lamps.

Impact and heat-resisting lens. A refracting screen can be furnished to direct the light in any direction, approximately 30 degrees from normal.

Sturdy grid for use where glass is exposed to breakage. Easily removed for cleaning lens.

***Alzak aluminum reflector.** Wide beam for short range. Narrow beam for long range or spotlight.

Gasket of oil and gasoline resisting material furnished if needed.

Write for additional information.

*Alzak is the registered trademark of the Aluminum Company of America.



Mountings, left to right: Portable; base; suspension; surface: for setting in concrete.



Type RLEE-14
500-watt

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Cities: Birmingham, Boston, Chicago, Cincinnati, Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, New York, Philadelphia, Pittsburgh, San Francisco, Seattle—St. Louis—Washington. Resident Product Engineers: Albany, Atlanta, Charlotte, New Orleans.

CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS

Things Will be Good Again

When war came many quality products disappeared from the civilian market. Patriotic America did without them. Or, when necessary, bought the substitutes that could still be purchased.

Frink Linolite Fluorescent Fixtures were not to be had, though the natural demand for them continued and grew. The skill of Frink Engineers, the precision of Frink workers—in fact, all the resources of a firm that for four generations had distinguished itself in the field of lighting—were mobilized for sterner business.

Now, surely the time is close when things will be good again, when *quality* can again be demanded. When that time comes, specify Frink Linolite Fluorescent Fixtures for your new lighting installations. By doing so you will assure yourself the optically diffused illumination of great uniformity, *engineered for vision*, that will characterize the best post-war lighting in homes, banks, stores, hotels and industry.

FRINK

L-I-N-O-L-I-T-E

THE ULTIMATE IN FLUORESCENT LIGHTING

THE FRINK CORPORATION, Bridge Plaza North, Long Island City 1, N. Y.

Subsidiaries: Sterling Bronze Company, Inc. • Barkon-Frink Tube Lighting Corporation

LIGHTING SINCE 1857



WHICH WOULD YOU WANT IN *Your* HOME?

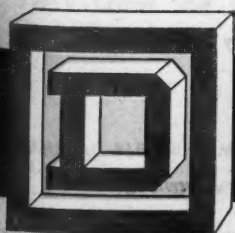
Of course you would—and so would the people for whom you're wiring new homes. For the fuss and bother of changing fuses simply doesn't fit into the modern way of doing things—not when Multi-breaker convenience and protection costs so little more than the fusible equipment it replaces.

The Multi-breaker eliminates fuses completely. When a short circuit or dangerous overload occurs, the circuit is cut off automatically. A simple movement of the lever restores current after the cause of the overload has been removed. There are

no delays—nothing to replace—nothing to buy or store.

If you want to see just how much the Multi-breaker idea appeals to new home builders, do this—quote both ways. See how fast they'll choose Multi-breakers instead of fusible equipment. See how often this procedure of quoting both ways paves the way to more and better wiring jobs.

If you don't have the complete Multi-breaker story, write for Bulletin 4000. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.



SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES



PLAN YOUR PLANT DRIVE NOW!

Good organization will be needed to sell the 6th. The task of raising the huge sum required will be the most difficult ever asked of Industry. As each new military success brings us closer to Victory, the public naturally will feel that the urgency of war financing is lessened—whereas it isn't. So organize now to prevent a letdown on the home-front from causing a letdown on the fighting front. Build your plant's payroll campaign around this fighting 8-Point Plan. You don't have to wait for the official Drive to start—swing into action NOW!

- 1 **BOND COMMITTEE**—Appoint a 6th War Loan Bond Committee from labor, management and each representative group of the firm.
 - (b) Pre-drive letter to employees from management and labor.
 - (c) Competitive progress boards.
 - (d) Meeting schedules, etc.
- 2 **TEAM CAPTAINS**—Select a team captain, for each 10 workers, from men and women on the payroll—but not in a supervisory capacity. Returned veterans make most effective captains.
- 3 **QUOTA**—Set a quota for each department and each employee.
- 4 **MEETING OF CAPTAINS**—Give a powerful presentation of the importance of the work assigned to them. Instruct them in sales procedure. Have them carefully study the Treasury Booklet, *Getting the Order*.
- 5 **ASSIGNMENTS**—Assign responsibilities for:
 - (a) Music, speeches and announcements of the opening rally.
- 6 **CARD FOR EACH WORKER**—Dignify each personal approach with a pledge, order, or authorization card made out in the name of each worker. Provide for a cash purchase or installment pledge. Instruct each captain to put a pencil notation on the card to indicate the subscription he expects to solicit from each worker.
- 7 **RESOLICITATION**—People don't mind being asked to buy more than once. Resolicit each employee toward the end of the drive in a fast mop-up campaign. Call upon your State Payroll Chairman; he's ready with a fully detailed plan—NOW!
- 8 **ADVERTISE THE DRIVE**—Use all possible space in the regular media you employ to tell the War Bond story.

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL CONTRACTING

This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council

TRUMBULL "AT" CIRCUIT BREAKERS



Hand 'em a quick "K.O."

The two dangerous antagonists of an ordinary switch . . . Overload and Short Circuit . . . are out of luck when they attack a Trumbull "AT" Circuit Breaker.

A thermal trip prevents trouble from momentary overloads . . . passes them on without current interruption.

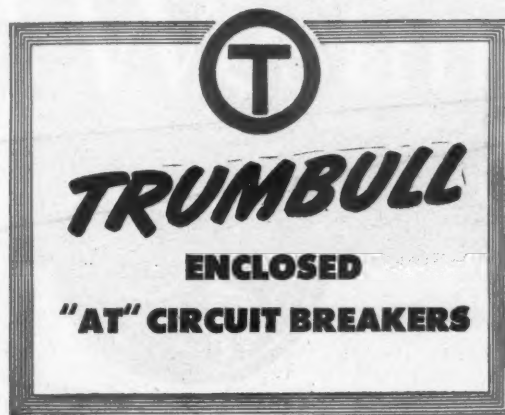
And when heavy overloads or short circuits threaten, the multipole common trip-bar *instantly* "Quick-Breaks" the circuit on all poles. Arc is broken up and smothered in an improved isolating chamber which keeps damaging elements from contacts and entirely away from the breaker mechanism.

Instant automatic tripping is indicated by the handle position . . . between "Off" and "On". When trouble has been removed, move handle to extreme "Off" and then to "On" for restored service.

"AT" enclosed Circuit Breakers are regularly listed in 2 and 3 pole, 15 to 600 amps. incl.—125 to 600 V.A.C. or 125 to 250 V.D.C. Also in single pole 50 amp. frame size breakers, 125 V.A.C. or D.C.

"AT" Circuit Breakers are an insurance against damage . . . no live parts exposed. Long service life is assured, without repairs or part replacements.

Illustrated and described in Trumbull Circular 314 (revised).



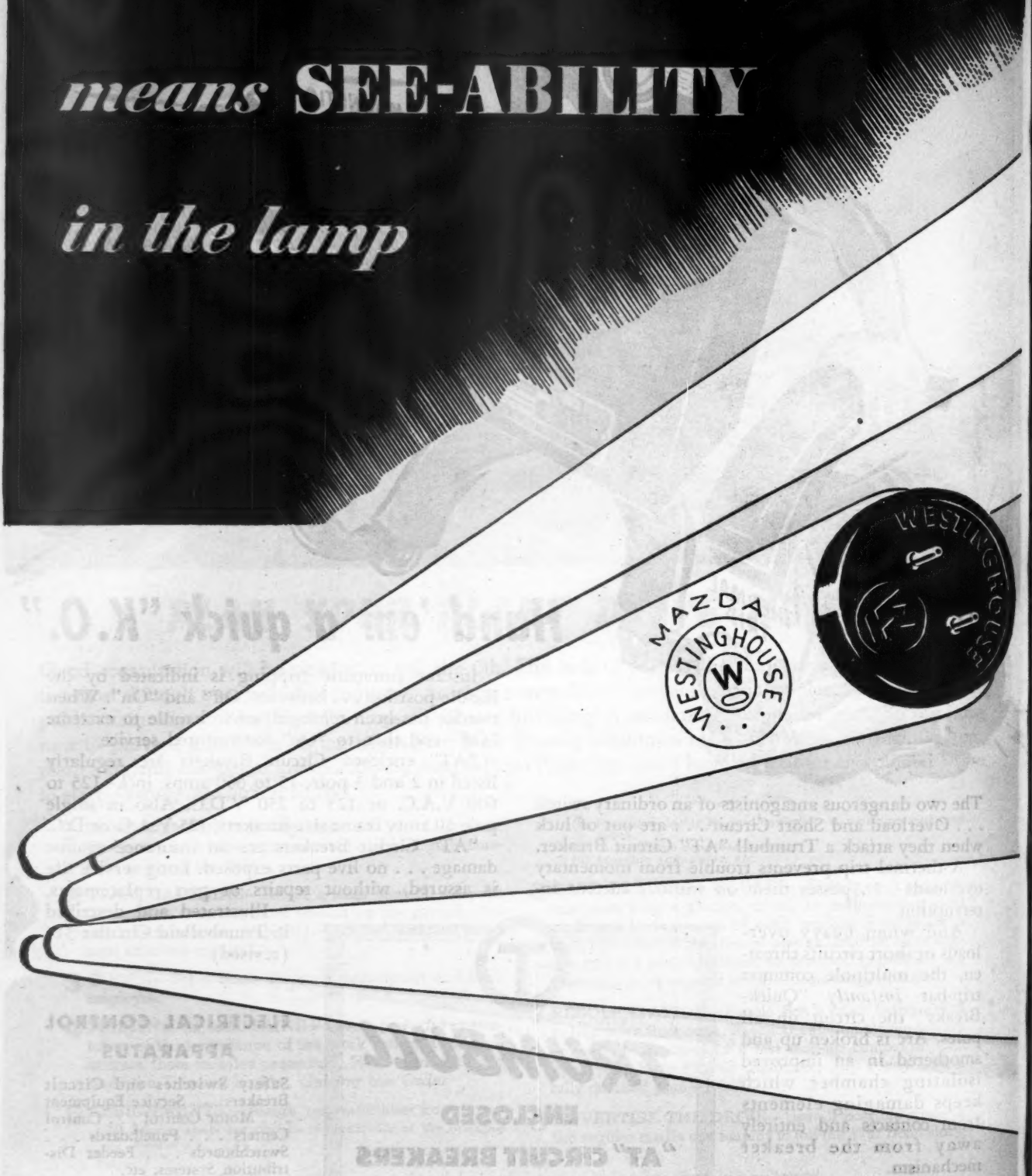
ELECTRICAL CONTROL APPARATUS

Safety Switches and Circuit Breakers . . . Service Equipment . . . Motor Control . . . Control Centers . . . Panelboards . . . Switchboards . . . Feeder Distribution Systems, etc.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

SMOOTHNESS *in the coating...*
means **SEE-ABILITY**
in the lamp



WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C.
 TED MALONE • MONDAY, WEDNESDAY, FRIDAY 10:15 EWT., BLUE NETWORK



Fluorescent powders are tricky things to handle. Especially when it comes to applying them *evenly* inside a glass tube!

Uneven distribution causes minute valleys and peaks. In valleys the coating is too thin to fluoresce, while the peaks form shadows.

Hence the necessity for perfect smoothness of application, and the uniform thickness of coating from end to end of the tube.

Achieving this result is the aim of every step in the exacting Westinghouse procedure. From processing of raw materials to the final mixing of the phosphor powder, Westinghouse methods are concentrated on making and keeping the fluorescent powder uniformly *smooth*.

Carefully controlled schedules of grinding, acid washing, firing and ball milling insure uniformity. This extra care and attention counts . . . keeps Westinghouse fluorescent lamps *bright from end to end*.

That's why it pays to recommend Westinghouse Fluorescent Lamps for every fluorescent lighting plan or installation. Supplies are available now for essential war lighting, and to a limited extent for essential civilian use. Westinghouse Electric & Manufacturing Company, Bloomfield, New Jersey.

HELP SHORTEN THE WAR . . . BUY MORE BONDS THAN BEFORE!



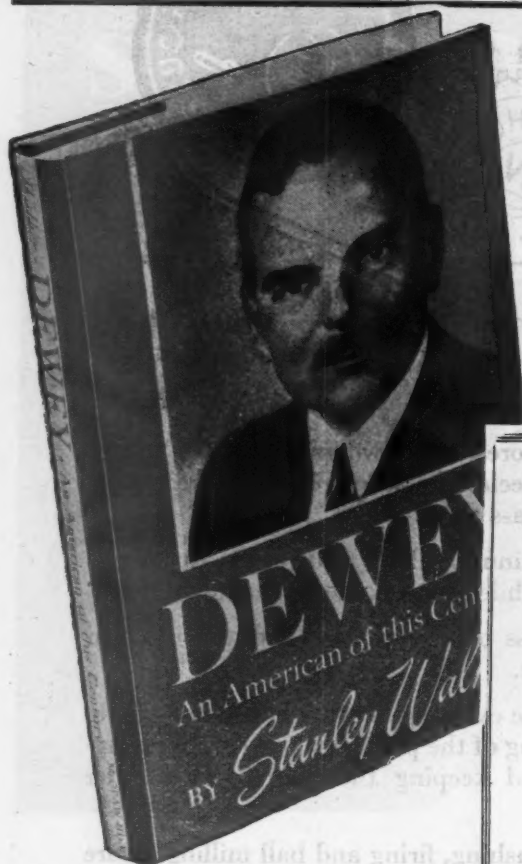
Westinghouse

PLANTS IN 25 CITIES

OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

JUST PUBLISHED BY MCGRAW-HILL



WALTER TROHAN, in the *Chicago Tribune*, says:

"For those who desire to become acquainted with the Republican candidate for President and what he stands for, this is a must book."

New York Journal-American:

"a straightforward picture of the Republican Presidential nominee without the usual worshipful embellishments to which most biographers are prone."

MARQUIS CHILDS, in the *N. Y. Herald-Tribune*, says:

"the Dewey story is here skilfully put together, and to many readers parts of it will be new."

DEWEY

An American of this Century

By STANLEY WALKER

Other McGRAW-HILL

Books of Current Interest

1. Raymond Clapper:

WATCHING THE WORLD

Edited and with a biographical sketch by MRS. RAYMOND CLAPPER. Introduction by ERNIE PYLE. \$3.00

2. ASIA'S LANDS AND PEOPLES

By GEORGE B. CRESSEY, Syracuse University. A geography of one-third the earth and two-thirds its people, with considerable attention to postwar aspects of geostrategy. \$5.50

3. BRAZIL ON THE MARCH

By MORRIS L. COOKE, American Technical Mission to Brazil. Absorbing study of the Brazilian economy in terms of national background, peoples, resources, and mounting industrialization. \$3.00

4. BULLDOZERS COME FIRST

By WALDO G. BOWMAN, N. A. BOWERS, ARCHIE N. CARTER, EDWARD J. CLEARY, and HAROLD W. RICHARDSON. Eyewitness story of U. S. war construction operations in foreign lands. \$2.75

(Order by number—Use coupon)

A full-length, authoritative, highly readable study of the Republican candidate, written by a veteran newspaperman. Here is the amazing record of the G.O.P.'s fighting standard-bearer . . . here are his principles and beliefs . . . here we see him at work and at play, in struggle and triumph. Supplemented by 145 pages of excerpts from Dewey's major speeches and statements. \$2.50.

Really know
this
candidate
•
Send this
McGraw-Hill
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330 W. 42nd St., New York 18

Send me the books checked and encircled below, for 10 days' examination on approval. In 10 days I will pay for books, plus few cents postage, or return them postpaid. (Postage paid on cash orders.)

☐ Walker's Dewey, *An American of This Century*, \$2.50

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Name

Address

City and State.....

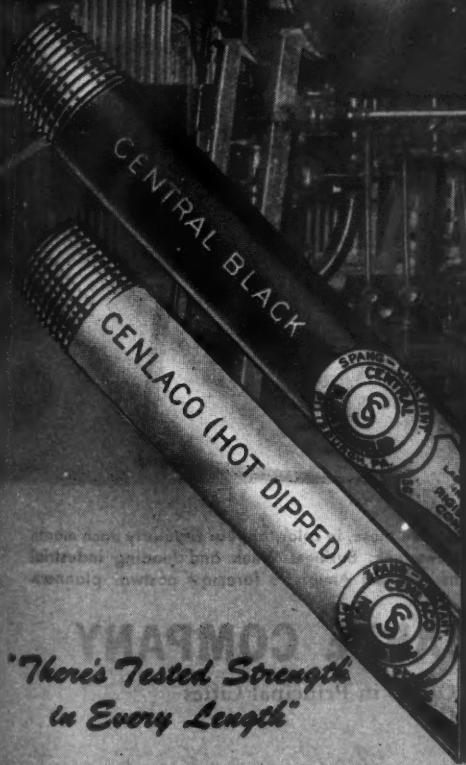
Company EC-10-44
(Books sent on approval in United States only.)

CONSOLIDATED GAS ELECTRIC LIGHT & POWER CO. OF BALTIMORE

Installed...

**CENTRAL
RIGID STEEL
CONDUIT**

For lasting Protection



*"There's Tested Strength
in Every Length"*

SPANG-CHALFANT

Division of The National Supply Company

Executive Offices: Grant Building, Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

Electrical Wiring

comes first!

Every electrical contractor will benefit from Anaconda's national advertising campaign

ANACONDA's advertising campaign is aimed at creating a sounder basis for your postwar business. It urges postwar planners to allow extra capacity in wiring plans. Naturally, this will increase the demand for *your* services—and service equipment.

Don't overlook the opportunity to tie in with this important campaign. Plan now to get a maximum share of postwar electrical business. Link your own promotion to your local adequate wiring bureau activities and Anaconda's basic advertising theme: **It's always wiser to Wire Ahead!**

44263 A

BUY MORE WAR BONDS



ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4... Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation

• Full pages like these, in color, appear regularly each month in Time, Newsweek, Business Week and leading industrial publications read by America's foremost postwar planners.



FOLKS WANT TO RIDE

One of the greatest advances in the history of industry came when automobile salesmen quit selling cylinder displacement, roller bearings and brass hardware. Somebody started to sell cars and effortless transportation and a great mass production industry grew and prospered.

Displacement and bearings are important. Highly trained engineers spend tedious hours figuring how much gas should be compressed into how much space, and the metallurgy of bearings alone is a wonderful subject. But folks want to ride—and leave the technical problems back at the factory.

Electrical construction, installation and utilization is on the threshold of a new era. That, pretty much everybody is willing to accept as inevitable. People want to push buttons and business enterprise unleashed from war work will give them what they want—and it will be electrical. A thousand tasks that called for hard labor will be done by machines if even a small fraction of the projected postwar gadgets and devices reach the market.

Lighting, grown phenomenally in a few years, offers literally a new way of life, and we are in great danger of underestimating its potential effect on our industry. The man-in-the-street expects a great deal and our planning is still inclined to be cautious and conservative.

So right now let's take a lesson from the automobile. Good lighting and the effective installation of electrical apparatus are complex jobs. They call for skilled engineering and competent workmanship. They call for proper plans and adequate wires and sturdy raceways.

They call for a thousand details which can very easily become a fascinating adventure to any man who has his heart in this great game. And soon we could be like the old auto man with his bearings and hardware, beautiful to him but confusing to his customer, selling a technical assembly when folks want to ride.

When the big selling job comes we have to keep in mind some important fundamentals: 1) electrical work has grown far too complex to expect the customer to understand the mechanism, 2) the customer wants light, power and control, he wants convenience, comfort, speed and other results of effective application and utilization.

And what of the pipe and wire, the feeders, the pull boxes, the fuses and connectors? What about power factor and line loss? Are these important? Vitrally so—but all the customer wants is the certainty that they have been considered, competently engineered and fairly priced.

It adds up to this. If we are going to meet the challenge of our postwar destiny, even half way, it is going to take an industry with a high order of business and technical ability plus a passion for integrity and sound engineering. When confidence is created, we can sell the glory of light and the thrill of power unlimited. Folks want to ride.

Wm. J. Stuart

Electrical Contracting

OCTOBER, 1944

MORE OF YOUR STORY for 40,000 Building Planners

THE GRAYBAR ADVERTISEMENT reproduced on this page appears in the October issue of Architectural Forum. It tells some 40,000 architects and leaders in the building industry — your customers — about the many ways they can use your growing, up-to-date industry to their advantage and your profit; advises them to let you in on the ground floor when plans are being made. To help you do a better job of planning and installation, your local Graybar Man is ready with the latest in supplies and information.

Have you FORGOTTEN TO CHANGE THE SLIDE ?



Could it be that your picture of the electrical contractor needs bringing up to date? As electrical usage throughout the building industry has grown more important and complex, *qualified* electrical contractors have grown as well.

Today the resources of the electrical contractor that are at your service include a large investment in specially-engineered tools to facilitate his work. In addition, his organization will include specialists in electrical planning and installation, ready to help you with electrical specifications or to supplement your knowledge of local conditions, code regulations and new materials.

The time to get together with your electrical contractor is before final decisions have been made on wiring and equipment. Why not enlist his aid on your current plans and proposals?

THIS TYPICAL TOOL LIST

shows what most of today's contractors require to serve you well

- | | |
|---|----------------------------------|
| Bench—Large | Electric Drills $\frac{1}{2}$ " |
| Bench—Small | Electric Drills $\frac{1}{4}$ " |
| Vises $\frac{1}{2}$ " to 2" | Drills—Twist Misc. |
| Stocks $\frac{1}{2}$ " to 1" | Taps Misc. |
| Stocks $\frac{1}{4}$ " to $\frac{1}{2}$ " | Whitney Punches |
| Stocks 2" Ratchet | & Dies |
| Stocks $2\frac{1}{2}$ " to 4" | K.O. Punches—Sets |
| Dies $\frac{1}{2}$ " & $\frac{3}{4}$ " | Air Hammers |
| Dies 1" | Electric Hammers No. 2 |
| Dies $1\frac{1}{2}$ " | Electric Hammers No. 4 |
| Dies $2\frac{1}{2}$ " | Reamers Misc. |
| Dies $2\frac{1}{2}$ "—3" | Star Drills |
| Thread Cutter Fr. Dr. | Hacksaw Blades |
| Bender Small | Bullpoints Misc. |
| Bender Large | Pinch Bars |
| Hickies (H.W.C.) | Socket Wrenches |
| $\frac{1}{2}$ " & $\frac{3}{4}$ " | Bolt Stock & Die Set |
| Hickies (H.W.C.) 1" | Extens. Confs |
| Thin Wall Bender $\frac{1}{2}$ " | Burners & Tanks—Gas |
| Thin Wall Bender $\frac{3}{4}$ " | Coffing Hoists |
| Thin Wall Bender 1" | Chain Hoist 5 Ton |
| Wrenches 18" | Rope—Hemp $\frac{1}{2}$ " |
| Wrenches 24" | Rope—Hemp $\frac{3}{4}$ " |
| Chain Tongs | Blocks Snatch & Misc. |
| $1\frac{1}{2}$ "—2 $\frac{1}{2}$ " | Wagon Trucks |
| Chain Tongs | Dollies |
| $2\frac{1}{2}$ "—4" | Jacks—Stone |
| Reamers $\frac{1}{2}$ "— $1\frac{1}{4}$ " | Sledges & Hammers |
| Reamers $\frac{1}{2}$ "—3" | Chain—Coll |
| Oilers | Carpenter Tools |
| Drill Press | Fish Tape 100'— $\frac{1}{8}$ " |
| Power Saw Univ. Band | Fish Tape 100'— $\frac{3}{16}$ " |
| Copper Bender | Fish Tape 200'— $\frac{1}{4}$ " |
| Iron Bender—Universal | Winches Hand Dr. |
| Tool Grinder—Elect. | Power Drive Universal |
| Work Bench | Wire Rope 120'— $\frac{1}{4}$ " |
| Machinist Vise | Wire Rope 200'— $\frac{3}{8}$ " |
| Electric Welder | Cable Pullers |
| Forge | "Come Along" |
| Anvil | Reel Jacks |
| Tool Boxes—Steel | Pick Up Cart |
| Tool Boxes—Wood | Breaks—Cable |
| Chains & Locks—Ladder | Reels—Pay out |
| Ladders—Step 6 ft. | Reels & Stand—Gang |
| Ladders—Step 8 ft. | Strippers—Wire |
| Ladders—Step 10 ft. | Gas Furnaces |
| Ladders—Step 12 ft. | Elect. Soldering Set |
| Ladders—Step 14 ft. | Steel Lettering Set |
| Ladders—Step 16 ft. | Floor Crane |
| Ladders—Extens. | Air Compressor |
| Scaffolding Mat. | Elect. Welder |
| Tool Grinders—Hand | Flex. Shaft Grinder El. |
| | Rolling Scaffold |

*Tool list from Electrical Contractors Association of City of Chicago.

GraybaR

Executive Offices: Graybar Building, New York 17, N.Y.



BIG JOB ORGANIZATION

OPERATING a large electrical construction project is no small task even in normal times. During the war period, with projects increasing in size; with acquisition of materials and manpower a struggle in itself; with the demands for increased ingenuity and the constant race against time, the problems pyramided rapidly. Only a highly organized and efficient field staff could weather the storm of difficulties that were inherent in such projects.

Just such an organization spear-headed the successful operation of a ten million dollar (7½ million construction and 2½ million machinery installation) electrical project in a newly built midwest war plant—one of the largest of its type in the world. Spread out over an area of approximately 600 acres and comprising 19 buildings, one of which alone covered 88 acres (22 of

How a joint venture group organized a ten million dollar electrical installation in one of the world's largest industrial plants.

By August Eckel

which are air conditioned) the project posed coordination problems that were never before encountered.

The electrical work was installed by three prominent Chicago electrical contractors—J. Livingston & Co.; Dearborn Electrical Construction Co.; and White City Electric Co., who combined their engineering talent and equipment resources in a joint venture under subcontract to the George A. Fuller Construction Company, who had charge of all construction work. Close

cooperation between the field staffs of the electrical contractors, the Fuller Company, the plant lessee and Albert Kahn, Inc., project architects, enabled a rigid construction schedule to be maintained without a hitch.

A closely coordinated, highly efficient field organization was the backbone of the electrical contractors' operations. Formed immediately after the contract was let, the organization was composed of five main divisions—Administrative, Engineering, Field Con-

MATERIAL AND EQUIPMENT INSTALLED ON THE PROJECT

CONDUIT

Nine cars of thin wall conduit
Six cars of heavy wall conduit
Five cars of fibre conduit

WIRE AND CABLE

75 cars of insulated wire and cable, sizes Nos. 16 to 750,000 CM., types SN, AVA, VCB, VC & L, and paper and lead insulation.
375,000 feet of four-conductor, heavy duty, power duct cable, sizes 12, 8 and 2. (Drops from bus duct plugs to motor controls on machines.)
A considerable number of service runs were open wiring on insulators.

BUS DUCT AND PLUG-IN DEVICES

7500 feet of 250-amp., 480-volt, Flex-a-Power
22,000 feet of 375-amp., 480-volt, Flex-a-Power
18,500 feet of 500-amp., 480-volt, Flex-a-Power
4,500 30-60 amp., 480-volt, 3-pole, Plug-In units
600 100-amp., 480-volt, 3-pole, Plug-In units
170 200-amp., 480-volt, 2-pole Plug-In units
200 200-amp., 480-volt, 3-pole Plug-In units

TRANSFORMER CAPACITY INSTALLED

45,000 kva.—Main Primary
—Three, 15,000 kva., 33-kv./12-kv. units
67,500 kva.—Interplant Primary Distribution
—66, 12-kv./480-volt units (500 kva. to 2500 kva. in size)
—5, 12-kv. 2400-volt units (2500 kva.)
17,000 kva.—Secondary Distribution
—Several hundred 480/120/240-volt units

SWITCH GEAR INSTALLED

1—29 Section, 15,000-volt, Main Board (Primary)
5—2400-volt, metal-clad switch gear cubicles (Power)
42—480-volt, metal-clad, cubicles (Light and Power)
1—240-volt, metal-clad, switch gear cubicle (Power)

PANELS

Several hundred light and power distribution panels

LIGHTING FIXTURES

8000 2-lamp fluorescent units
11,500 Combination Mercury-Mazda units (10,500 four-lamp units—three mazda, one mercury; 1000 two-lamp units—one mazda and one mercury.)
3,000 commercial lighting units for general lighting
168 6.6-amp. series lighting units for parking lot lighting

LAMPS

11,500 400-watt mercury-vapor lamps
43,000 incandescent mazda lamps—60 to 750 watts
16,000 fluorescent lamps—40 to 100 watts

FIRE ALARM SYSTEM

Gamewell—One Special Vitaguard Senior Control Unit with 107 signal stations

AUTO CALL SYSTEM

Several hundred 3-section Signalling stations, operated from three master sending stations

TEMPORARY LIGHT AND POWER

Distribution wiring and fixtures, including installation labor and overhead, in excess of one million dollars.

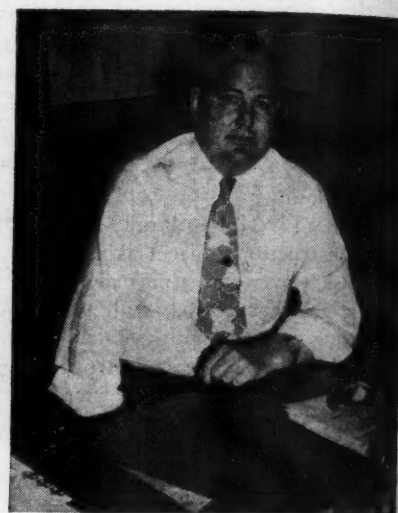
Note: The above list covers only the salient items of material and equipment and does not venture to include the thousands of smaller items and accessories that combine to make a complete electrical installation. This list is designed to give some conception of the physical size of the electrical project.

(Including necessary clerical help)

Executive Board	3
Administrative	5
Engineering Dept.	29
Purchasing Dept.	12
Accounting Dept.	57
—Accounting—14	
—Timekeeping—20	
—Payroll—10	
—Warehouse—11	
—Personnel—2	
Field Construction Dept.	1090
—Field Supt.—1	
—Asst. Field Supts.—7	
—General Foremen—17	
—Foremen—65	
—Electricians—964	
(includes 80 Linemen)	
—Truck Drivers—36	
TOTAL PERSONNEL	—1196



PROJECT MANAGER for the joint venture group, Robert F. McCaw combined his engineering and executive talents to coordinate the activities of the electrical contractors' field organization, located at the job site.



CHIEF ELECTRICAL ENGINEER
Glen B. Shutts, and his staff were responsible for the detailed electrical system design with the resultant savings in critical materials. More than 600 detailed field drawings were made.

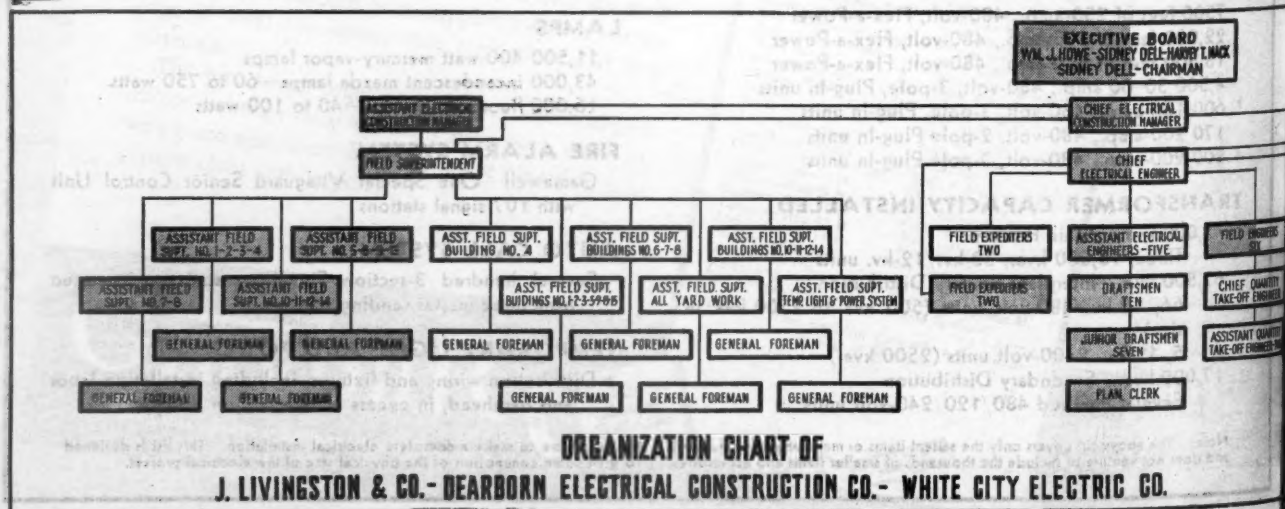
All policies of the joint venture group were formulated by an Executive Board comprised of the late Sidney Dell (president, Dearborn Electrical Construction Co.), as chairman; William J. Howe (vice-president J. Livingston & Co.); and Harvey T. Nack (president White City Electric Co.) The entire field organization, located at the job site, was under the supervision of a chief electrical construction manager, Robert F. McCaw—a construction engineer with several large war plant projects to his credit—and an assistant electrical construction manager, S. B. Stoler (J. Livingston & Co.) who had full jurisdiction over the field construction division.

staff of 28 composed of five assistant electrical engineers, each one responsible for engineering on a specific group of buildings; several field engineers; three quantity take-off engineers; more than a dozen draftsmen; several field expeditors and a plan clerk. These engineers took the basic plans of the architects and developed some 600 detailed tracings for use in the field, coordinated the plans and requirements of other construction trades, used their ingenuity in making designs that required the least amount of critical materials and in general paced the actual field installation.

Acting as liaison men between the engineering and purchasing departments and the job warehouses were the field expeditors. All material requisitions originated in the engineering department, went to the purchasing de-

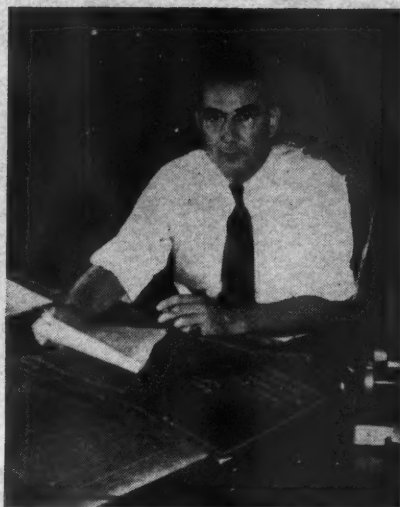
partment where—after being submitted to the general contractor, lessee and architects' representatives for concurrence as to type, quality, etc.—they were ordered following the receipt of at least three quotations. Items not marked for immediate delivery were delegated to the expeditors who followed through until scheduled delivery was made. One "expediter-at-large" spent his entire time on the road coordinating the efforts of suppliers and manufacturers to secure the material and equipment needed to meet delivery dates.

All purchasing of electrical materials was under the direction of L. E. Mayer, (a past president of NECA) whose background in the contracting and wholesale fields fitted him admirably for the job of chief purchasing agent. With his staff of one assistant





CHIEF PURCHASING AGENT L. E. Mayer kept the wires humming during his successful, nation-wide hunt, to insure a constant flow of materials to this huge project—taking priorities and allocation problems in his stride.



ASSISTANT PROJECT MANAGER S. B. Stoler had complete charge of all construction work in the field, supervising the dispersal of men and materials to attain the highest production efficiency.



CHIEF ACCOUNTANT C. O. Pflueger had full responsibility for compiling all job records—an important phase of any construction project. The smoothness with which details were handled attests efficiency of his staff.

purchasing agent, five buyers and the necessary clerical help, he kept the phones busy daily exhausting all possible supply sources throughout the country to insure a constant flow of material to the project. Although all material bills were paid by the general contractor, actual purchasing was done by the electrical contractor whose responsibility it was to see that the right materials were on the job at the right time. All priorities and allocation problems were handled by this department.

The electrical contractors "service of supply" consisted of a large central warehouse where all delivered materials were checked-in and several sub-warehouses strategically located at specific building areas where the materials were immediately dispersed upon arrival. The field expeditors mentioned

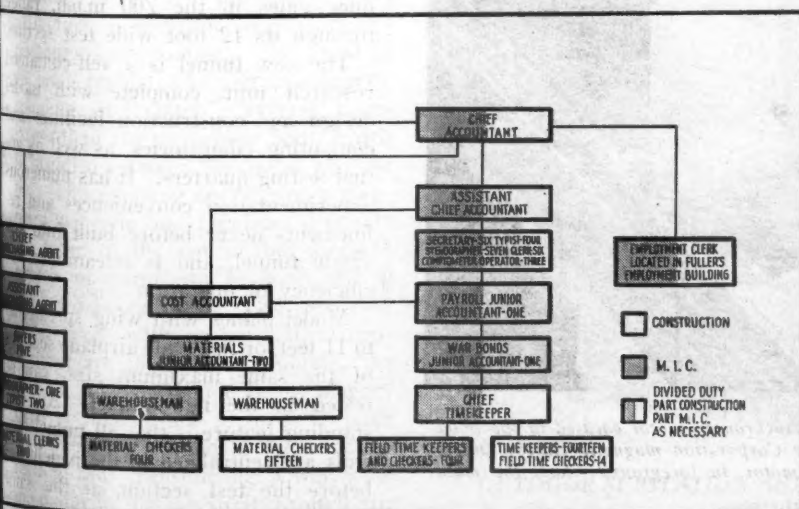
before worked in close touch with these warehouses to assure working crews a supply of materials at all times. Tools were dispersed in the same manner with each foreman in the field responsible for tools issued to his men on a requisition basis. To get the job rolling at the start, the three contractors pooled some of their tool stocks. However, most of the tools used on the job were purchased by the government, this being a D.P.C. plant, and most of the rolling stock (trucks, cranes, scaffolds, etc.) was rented by the government.

Working under the direct supervision of the assistant electrical construction manager and in cooperation with the chief electrical engineer, was field superintendent A. D. O'Hara (J. Livingston & Co.) who was responsible for the actual installation work for the

entire project. His staff of six to ten assistant field superintendents were assigned, each to a specific group of buildings with full responsibility for coordinating all electrical work therein. Each assistant superintendent had under him one or more foremen and crews of electricians—the most economical ratio for this project being ten electricians per foreman. All yard and line work was under one assistant superintendent as was all temporary light and power work (which had reached 2700 kw. before relief from a permanent substation could be had) for working inside and outside of the buildings night and day. With a sizable crew of electricians working at all times (peak approximately 1000), the field construction staff was kept ever on its toes.

The importance of keeping accurate records on any job cannot be over-emphasized. On a project of this magnitude it was a tremendous undertaking. The brunt of this laborious chore fell on the shoulders of chief accountant C. O. Pflueger (J. Livingston & Co.) who had a staff of some 57 persons under his supervision. Working directly under the assistant chief

[Continued on page 204]

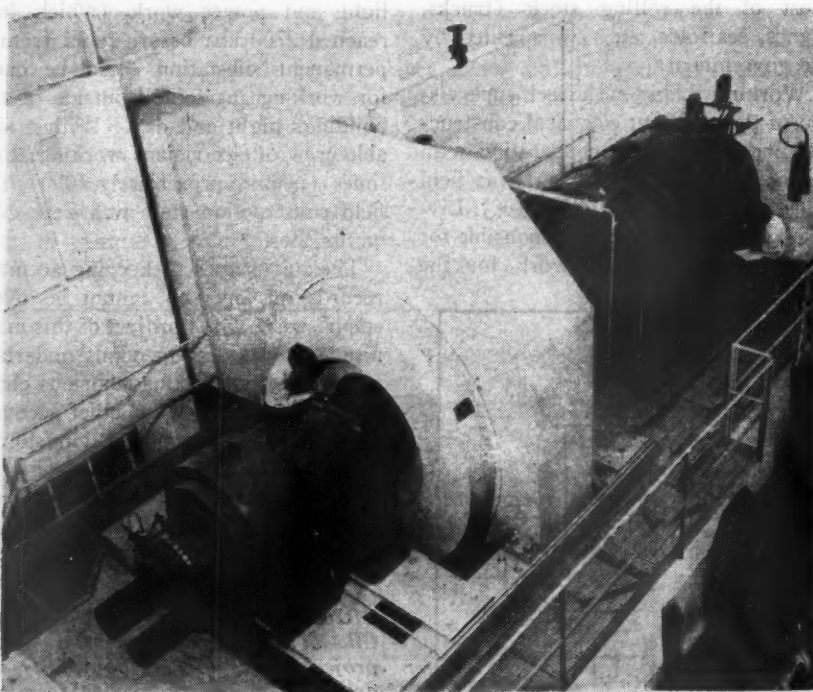


ORIGINAL FIELD ORGANIZATION CHART, developed at the start of the project shows how responsibility was delegated and work divided to obtain maximum efficiency. Close adherence to the chart effected economies in manpower (over that indicated in chart) and maintenance of a strict construction schedule.



TUNNEL THROAT where models are tested is illuminated by flush lighting above the observation windows.

WIND TUNNEL POWER



GIANT 18,000 hp, 514 rpm. Westinghouse synchronous motor encased in the hood drives the tunnel fan through the Dynamatic Corporation magnetic clutch, largest ever built, in the background. A 400 hp. motor, in foreground, starts the main motor.

AMERICA'S fastest large wind tunnel is capable of generating super-hurricanes approaching the speed of sound in which will be born and nurtured many of the planes of the future. Fastest of any wind tunnel in the country with test sections more than two feet in diameter, the new Boeing Aircraft Company's experimental laboratory, built by the Austin Co., can produce gales in the 700 m.p.h. range through its 12 foot wide test section.

The new tunnel is a self-contained research unit, complete with model design and construction facilities and computing laboratories, as well as actual testing quarters. It has numerous experimentation conveniences and refinements never before built into any single tunnel, and is streamlined for efficiency of operation.

Model planes with wing spreads up to 11 feet, or full-scale airplane sections of the same maximum size, can be tested in the new tunnel. An outstanding feature is that all tunnel controls are centralized in the panelboard before the test section, at the same

Economical

Boeing's Seattle aeronautical test tube uses an 18,000 hp. synchronous motor and world's biggest magnetic clutch.



MASSIVE FOUNDATIONS for the fan motor and clutch and the motor room are isolated from the tunnel foundation and hold vibrations to a minimum.

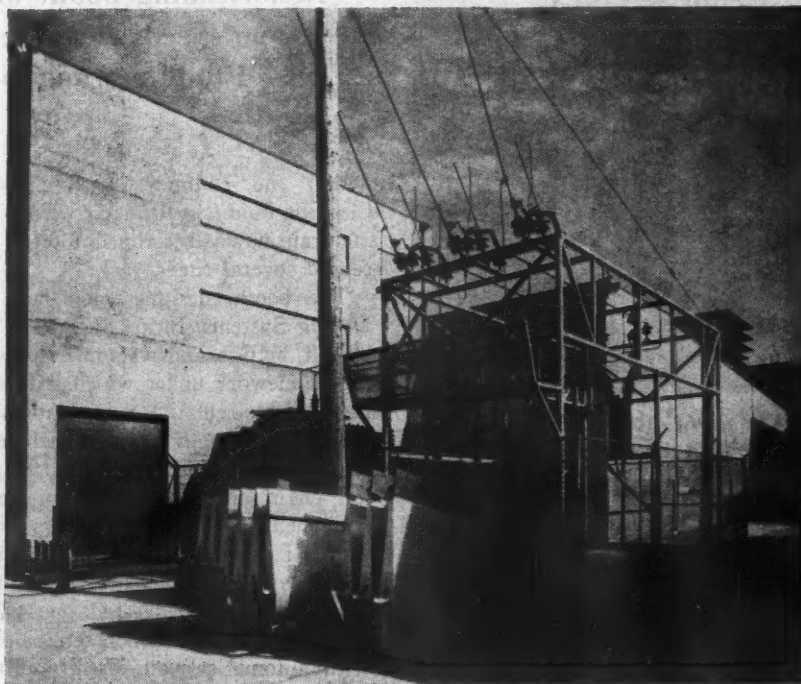


COMPUTATIONS AND CHART making is handled in an acoustically treated room under closely spaced rows of fluorescent industrial lighting units.

place where observations are made.

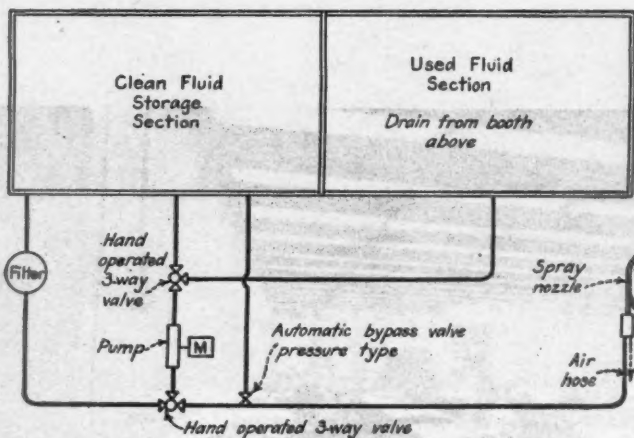
The tunnel's tremendous flow of air is created by a great propeller-like fan 24 feet in diameter. This fan consists of 16 laminated spruce blades mounted on the end of a 37-foot solid steel drive-shaft, 16 inches in diameter, which connects fan with motor and clutch.

The synchronous electric motor has a rating of 18,000 horsepower and maintains a constant speed of 514 revolutions per minute. The speed of the fan is regulated by a great magnetic coupling or "clutch", several times larger than any previously built, which is installed between the motor and the fan. This coupling operates on a magnetic principle and regulates precisely the speed of the fan so that airplane models or parts can be subjected to exact wind conditions. Two revolving metal rings, with no mechanical connection, are inside this coupling, the ring on the motor side being magnetized so that when it turns it pulls the other ring around in the same direction, thus transmitting power from the motor to the fan shaft through air.

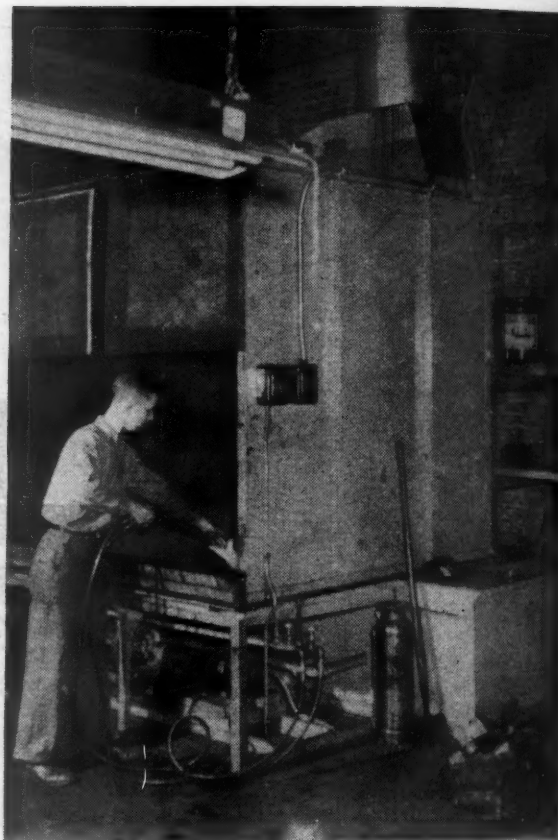


OUTDOOR SUBSTATION AND TRANSFORMER bank provides power for the operation of the wind tunnel.

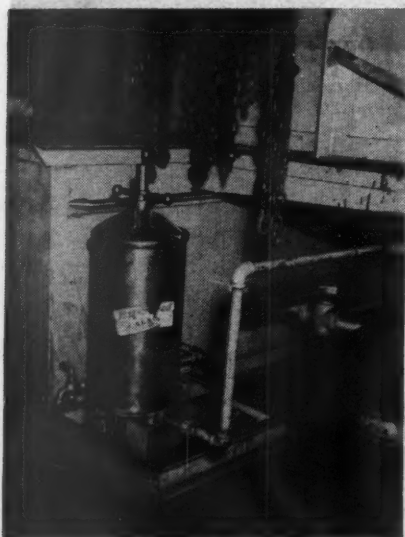
Economical Cleaning



THREE-WAY circulating system with simplified piping scheme permits use of used fluid for initial cleaning chore; use of clean fluid for final cleansing spray; and filtering of used fluid with subsequent storage in the clean fluid tank.



ROOMY BOOTH speeds cleaning operations in this motor repair shop. Boxlike protrusion at rear of booth is the "used fluid" storage tank with hinged cover. A similar "clean fluid" tank extends beyond opposite side of booth. Front of booth overhangs the circulating pump and piping system. Switches on side are for circulating pump and exhaust fan.



SAVES DOLLARS—This renewable filter device combined with the fluid recirculating system saves cleaning fluid.

A NEW cleaning booth is responsible for a marked reduction in cleaning time and expense at Excel Electric Service Company, Inc., one of Chicago's leading motor repair shops. Jobs that formerly were denuded of their dirt and grime in a far corner of the shop now are handled

New cleaning booth with filtered fluid recirculating system speeds cleaning operations and saves two barrels of fluid per month at Excel Electric Service Company's Chicago shop.

within the confines of the booth. Cleaning fluid that formerly went down the drain now is reclaimed, filtered and reused several times.

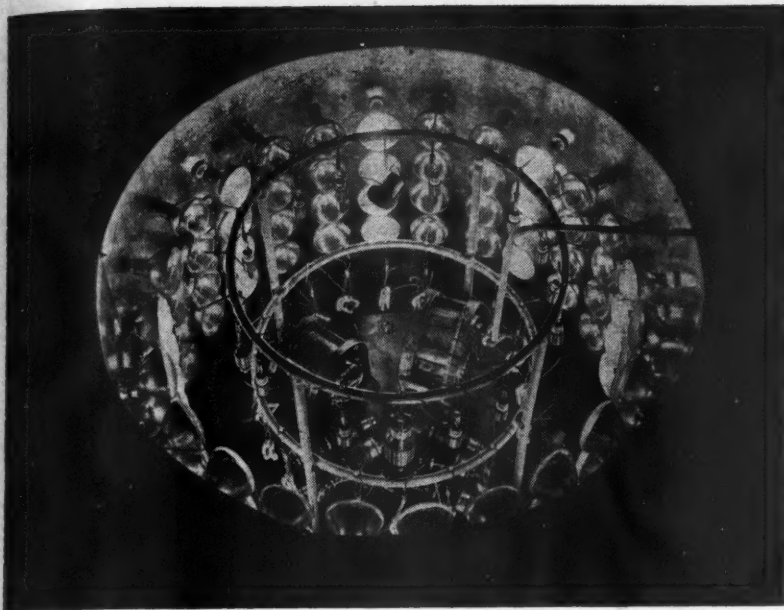
The booth, designed and built by Drying Systems, Inc., Chicago, is 6-ft. by 6-ft. by 6-ft. and rests on a supporting framework under which is located the fluid recirculating system and storage tanks. Booth features include: a rectangular opening in the top to permit chain hoist suspension of heavy equipment; heavy canvas flaps over the top half of the booth face to confine the fumes until removed by the built-in exhaust fan; an inverted one gallon glass container of carbon tetrachloride with automatic head for fire protection; a vaporproof light inside the booth; and a steel grating floor on

which motors can be set and through which the fluid returns to the storage tank.

One salient economical feature of the design is the cleaning fluid recirculating and filtering system. Under the back of the booth are located two 120-gallon storage tanks—one containing the clean and filtered fluid; the other acting as a storage receptacle for the used fluid which drains from the booth. Both tanks are 4-ft., 6-in. long; 32 inches wide and approximately 24 inches deep. They are mounted end-to-end on the floor and are equipped with hinged covers that extend beyond the booth proper.

By means of a set of three-way valves and a motor driven centrifugal

[Continued on page 204]



LOOKING DOWN into the bake tank. Note the unique turntable superstructure with novel arrangement for rotating each armature 120 degrees for each revolution of turntable. Large work rests on turntable base.

A cleverly designed infra-red oven, conceived and built by the electrical maintenance department at Consolidated Vultee's Fort Worth plant, evenly bakes electric drill armatures as they slowly rotate within a circle of heat lamps.

Infra-Red BAKE TANK

WHEN the electrical maintenance department at Consolidated Vultee Aircraft Corporation's Fort Worth, Texas plant set up an electric drill repair section capable of handling from 450 to 500 drills per day, there arose the problem of quickly baking large numbers of rewound armatures and coils. After careful consideration, infra-red was chosen and a tank-type oven was built to fit the mass baking requirements.

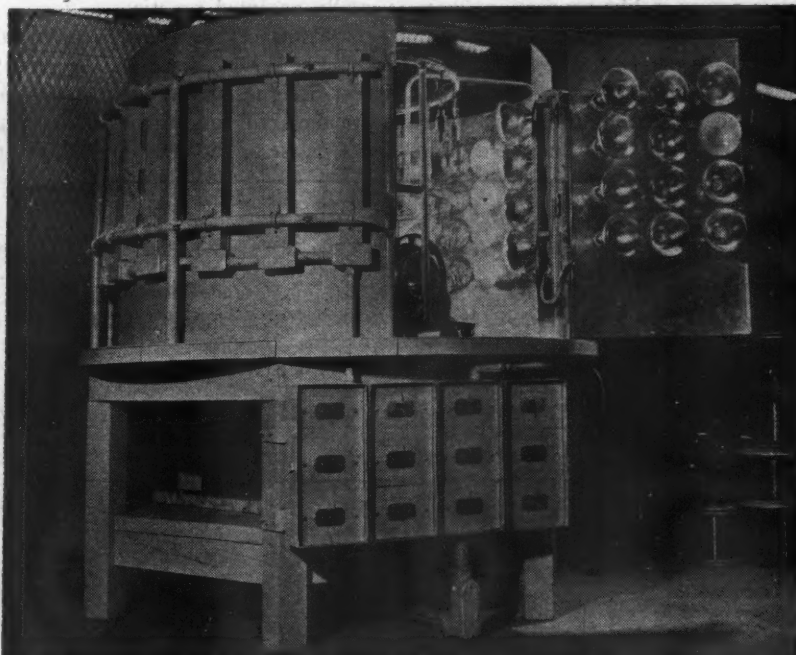
Basically, the design embodies the use of a 55-inch diameter, 34-inch high sheet metal cylinder mounted on a sheet metal reinforced wood platform equipped with a slowly rotating turntable which rests on casters a few inches above the metal bottom of the "tank". Equally spaced around the perimeter and protruding through this shell are four tiers of 24 sockets each—accommodating 96, 250-watt heat lamps with a total load of 24 kilowatts. The sockets are mounted to short vertical sections of wiring trough on the tank exterior—four sockets per section—and fed by a conduit raceway which encircles the shell. The front segment of the tank, containing 12 lamps, opens as a door to facilitate loading the turntable with work. When closed, it completes the circle of heat rays directed on the

work. The entire tank structure with socket and wiring troughs is supported by a welded, 1/2-inch pipe frame fastened to the platform.

Flexible heat control is provided by a bank of 12, twin-unit circuit breaker

panels mounted to the front face of the open pedestal. Each circuit breaker controls one vertical group of four lamps. For normal baking of drill armatures only 24 lamps are utilized.

[Continued on page 205]



INFRA-RED TANK equipped with a motor-driven turntable to bake small drill armatures at Consolidated's Fort Worth plant. The bank of 96 lamps is flexibly controlled by 24 circuit breakers. Usual baking "run" for drill armatures is two hours with 24 lamps on the line.



Unit substation rated 3,000 kva., with 3,900 kva. air blast rating 13200/4160 volts.

UNIT SUBSTATION

Several typical transformer and switchgear arrangements to indicate the simplicity and flexibility of load-center distribution

THE advent of war demanded expansion of production facilities in the order of thousands of percent. Electric power in like proportions was needed to efficiently light new and old factories alike, and to turn the wheels of this giant industrial war machine.

In order to speed installation, save critical materials and increase the

flexibility of electrical distribution facilities, loadcenter, unit substation type of high voltage distribution became universally accepted practice.

Transformers, switchgear and feeders can be arranged in a number of different designs depending upon the requirements of the particular installation. Some of the determining factors

are the power company's transmission voltage, plant capacity, number of load centers, length of feeders, stability and continuity of service requirements, and possibility of loadcenter shifting.

With reference to Fig. 3, two power transformers can be supplied with throat-connected feeder switchgear located between for application requiring two independent power transformation sources.

With reference to Fig. 4, a high voltage selector switch permits connection of power transformer to either of two incoming feeders. In addition to the necessary low-voltage switchgear, unit substations can be equipped with high-voltage switchgear if the power supply is not over 13,800 volts. One or more high-voltage breakers can be provided as required for radial, parallel line or loop supply.

In Fig. 5, the dimensions given are typical of a network distribution unit substation rated 2,500 kva, 34,500/4,160 volts. Low voltage switchgear includes five 5 kv., 600 ampere air breakers. Total weight is approximately 57,000 pounds including HV terminal chamber, pothead and disconnect switch.

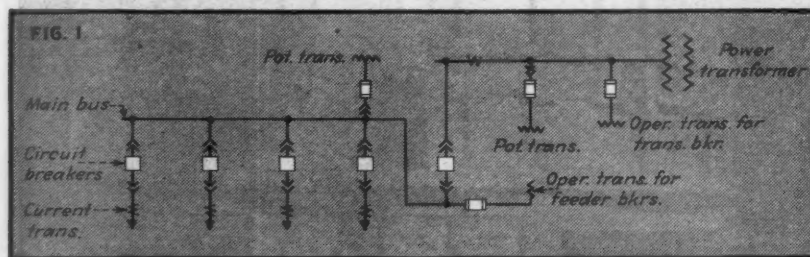


FIG. 1 Typical schematic for primary network distribution.

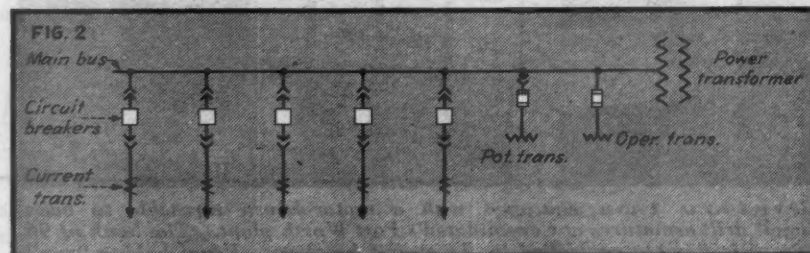


FIG. 2 Typical schematic for radial distribution substation.

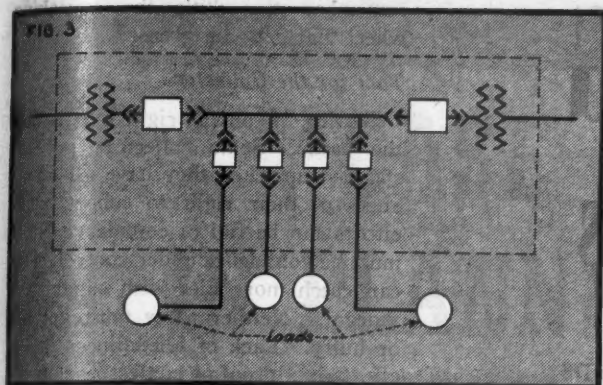


FIG. 3 Typical schematic for double-ended unit substation.

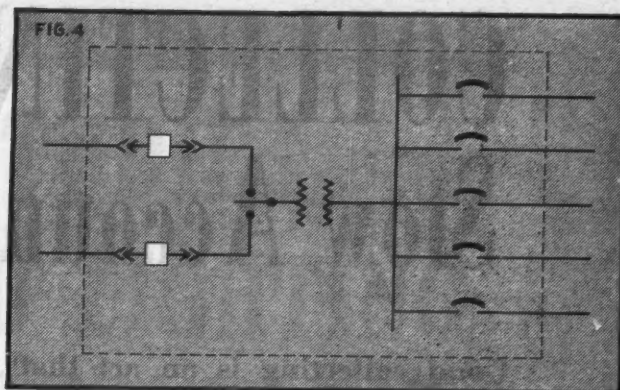


FIG. 4 Typical schematic for two incoming high voltage lines with h.v. selector switch.

By J. S. Parsons
Distribution Engineer
Westinghouse Elec. & Mfg. Co.

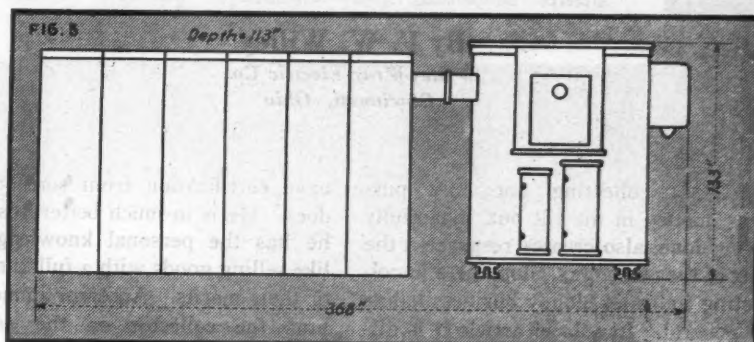


FIG. 5 Typical dimensions for network unit substation.

N LAYOUTS



Unit substation 2000 kva. 11500/4160 volts with tap-changing under-load equipment.

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COLLECTING Slow Accounts

**Good collecting is an art that keeps
your working capital working for you.**

By F. W. Willey
Willey-Wray Electric Co.
Cincinnati, Ohio

GOOD collecting not only puts money in the till but, if tactfully done, also creates respect on the part of the customers. Sloppiness in collecting indicates sloppy business habits in general. In a brief article it is difficult to show how to do a good job of collecting. There are such varied conditions that no one answer can cover the field. There are, however, some basic principles and an effort will be made to outline them. Then we will follow one procedure that has worked successfully but readers must consider it purely as an example. There are probably many others. No one procedure can be applied to every customer so there must be certain flexibility. The commercially printed collection letters have doubtful value because of their inflexibility. Many of us have fallen for them at one time or another and have suffered. A good customer is usually offended at them and, after all, our good customers are our greatest asset. Poorer customers throw such letters away.

The story assumes that the invoice has been rendered in proper form and reasonably close to the time that the order has been completed. It also assumes that at least one statement has been sent as a reminder so that the customer has had ample notice that payment is due.

Basic Collecting Principles

Correctness of Charges.

The collector should know what the charges are for and that they are correctly made. If he cannot have personal knowledge of these facts, he should

have certification from someone who does. He is in much better position if he has the personal knowledge. It's like selling goods with a full knowledge of their merits. An error immediately puts the collector on the defensive which is the first step to defeat—or at least a break in confidence.

Checking Charges with Customer.

It is awkward to ask a customer why he doesn't pay a past due charge when he has no record of it. On rare occasions the mails fail. On many occasions invoices must be ok'd by one or more customer employees and are delayed in getting to the party who pays the bills. It is well therefore to open the initial request with something like "We have a charge on our books that is past due and I want to check with you to be sure we are correct. It is dated . . . and covers . . . Do you have such a record? Are we at fault in any way that holds up payment?" Satisfactory answers establish the right of the collector to prepare his offensive, knowing that he is backed by full legitimacy of action.

Confidence of Collector.

The collector must have the inner confidence of the right to collect. Too many of them have the feeling that the customer is doing a favor by paying a bill. Assuming that the customer has the record of a correct charge that is past due, he has a moral responsibility to pay and there is no need of the collector to grovel in the dust before him to press his collecting efforts. The right is on the collector's side. For slow pay customers we must always

remember that "it's the squeaking wheel that gets the grease".

Tact for the Collector.

Getting off on the right foot is half the battle. Some collectors get too steamed up when they have all assurances of their right to collect. The efforts can be full of confidence but it must be confidence under control. One can catch more flies with sugar than vinegar. Neither party must get hot or huffy. Lack of friendliness in the efforts is a proof of tactlessness on the part of the collector. A customer who will not respond to confident and truly tactful and friendly efforts of the collector should be taken off the books as quickly as conditions permit.

The collector is as much a salesman for the company as the man who gets the orders. He must never forget that point in collection letters or phone calls. He is the man who completes the transaction with the customer.

Persistence.

It is illogical for the collector to make a fixed rule of following up on all slow accounts. He must treat them individually and apply *ALL* the persistence that each will stand and still hold friendly relations. A promised future payment must be followed up as soon as it is certain that it has not been fulfilled. The customer must be convinced that collection efforts are sincere and that his neglect will be followed up. Lack of persistence shows either weakness or sloppiness and only prompts the customer to disregard his former promises. Indifferent follow-up may be blamed for half the collection failures.

One Collecting Plan

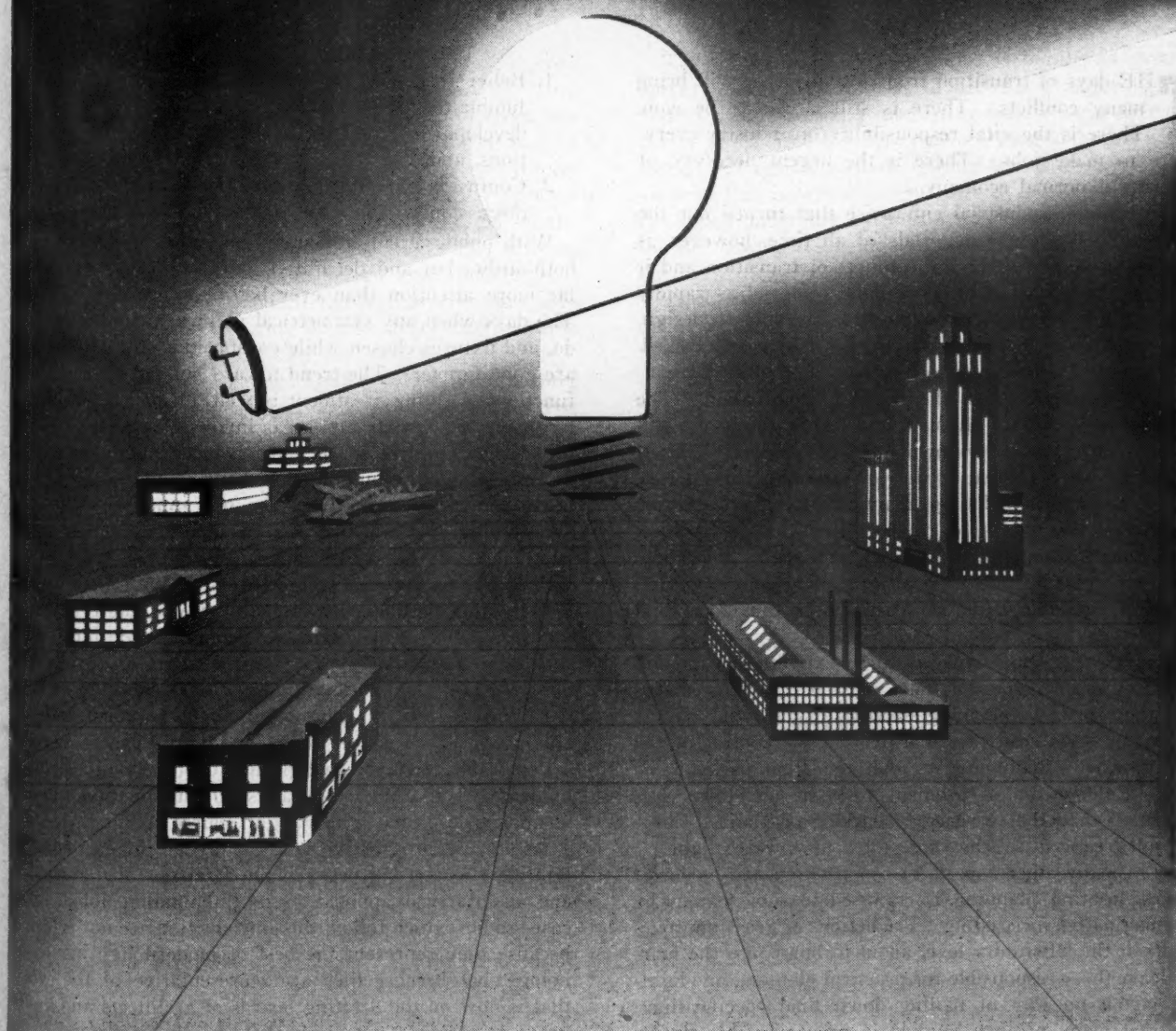
This portion is written with certain trepidation lest some reader think it is *the* plan. It is only one plan that has worked very well under particular conditions of relationships to customers. It has produced collection results.

First—No statements are issued before the 15th of the month. Then statements are made up in duplicate only on those accounts where there are items more than 45 days old. The collector receives both copies of the statements. He mails out all original copies and makes a careful study of the duplicates for planned action. No action is taken until the 20th which allows five days for the customer to pay. During that time the collector studies any odd cases, such as a small but old item on

[Continued on page 203]

CASE STUDIES IN PLANNED LIGHTING

A selection of representative lighting layouts, from already completed plans of architects and engineers, for immediate postwar action. A guide to practical planning and a comprehensive review of current lighting regulations and limitation orders.



ELECTRICAL CONTRACTING ... OCTOBER-1944

Electrical Contracting, October 1944

PLANNED LIGHTING

The way ahead in the field of lighting is clearly a broad highway of great progress. We have come a long way in a few years. Yet the best we know today is evidently only the beginning of a new lighting era.

THE days of transition from war to peace will bring many conflicts. There is still a war to be won. There is the vital responsibility on industry everywhere to make jobs. There is the urgent necessity of restoring a normal economy.

The brilliant industrial enterprise that turned out the greatest flood of war materials of all time, however, is fully competent to solve the conflicts of transition and it is to be hoped that barriers will be removed as rapidly as possible to allow the maximum of freedom to design, plan and build where the war effort will not be impeded.

One of the greatest opportunities for sound and constructive planning is in the field of illumination. The market is tremendous; the march of lighting progress will affect workers in every town and community. The industry includes a great variety of business enterprises, large and small, including manufacturers, wholesalers, contractors, architects, engineers, and electric utilities. The growth of modern lighting in turn affects the whole broad structure of the electrical industry; generation, distribution, manufacturing, construction, maintenance and service.

If this great opportunity is to be exploited to the full measure of public benefit there must be "imagineering", then there must be planning—accurate substantial layouts of real projects ready to turn over to the contractor for execution with the luminaires and lamps that are available now. Refinements of products to come are today less important than that we have a backlog of planned lighting jobs ready to set the stage for a new era of light.

As in many other aspects of construction and modernization, lighting planning is confused to some extent by too imaginative forecasting. Predictions of great improvements at the laboratory level about to burst into the market leave those responsible for practical planning and lighting layout no way of nailing down final specifications. A great many projects studied in preparing this section were found to be complete in all plans and specifications excepting those for electrical work. Uncertainty was ascribed to two fundamental causes—

1. Belief that individual manufacturers of lamps and luminaires are holding back important lighting developments awaiting relief from wartime restrictions, and,
2. Confusion over the present hot versus cold cathode discussions in the field of fluorescent lighting.

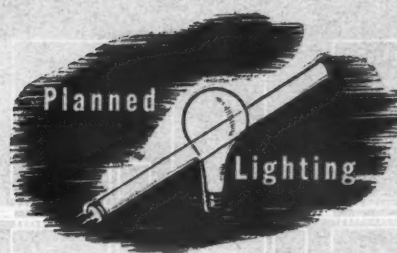
With public attention acutely conscious of lighting for both utilitarian and decorative purposes, it is receiving far more attention than ever before in building design. The days when any symmetrical pattern of outlets would do, and fixtures chosen while construction got under way, are gone forever. The trend toward built-in lighting and functional lighting treatment is well advanced. And the large number, variety and areas involved in modern lighting design requires space and advanced planning.

Thus lack of assurance that lamps and fixtures now being shown and advertised are not going to be immediately outmoded is a very real problem and one that can be solved only by bolder and more vigorous sales work and education by the manufacturers. While, obviously, new lighting developments are on the way, there is every indication that present lamp and luminaire designs offer the lighting man every facility for creative application and treatment with little danger of early obsolescence.

Confusion over the hot-cold cathode argument can be eliminated only by fewer claims and more facts. There is a deplorable tendency in lighting to blithely ignore well known and thoroughly established illumination fundamentals every time a new light source is introduced.

As in any progressive and rapidly advancing science, lighting shows a lag between the forefront of the science and its practical application to illumination jobs. The case studies which follow this introduction are not selected because they represent the best of modern lighting technology, but because they are representative of the work that is now on the drafting boards of architects and engineers responsible for work that will be forthcoming in the immediate postwar era. These examples of lighting practice are indicative of the progress of the art in practical applications. They represent the kind of jobs that

FOR POSTWAR



are economically, and from the standpoint of design, conservative.

Today, hard boiled business men want and expect this kind of lighting. They are willing to pay for it, in first cost, in maintenance and in kilowatt hours. These projects are far ahead of pre-war conception of normal lighting essentials. They are, however, only the beginning of the postwar potential in lighting application; the starting place, if you will, of postwar design and application.

The foundations of modern lighting practice are substantial and sound. In spite of an extraordinarily rapid growth, the science of lighting has built well.

The case studies in planned lighting which are described on the following pages give, in a practical perspective, some important indications of how lighting is coming of age. In each instance the lighting scheme is adapted to the seeing task to be performed. The structural features of several of the projects are developed to take the best advantage of the lighting method. If we may generalize from these samples, the trend toward functional lighting which has been evident in better lighting jobs for several years is now fully developed.

There is, however, evidence of severe economies in materials, a result, in all probability, of wartime experiences in lighting layout and fixture design. It is safe to predict that this is a passing phase of no permanent significance. In fixture design, particularly, some of the architects reported that they were planning with currently available types with the probability that newer designs would be adopted as soon as they became available.

Several of the following studies are of unusual interest. For instance, the Goldwater Memorial Hospital lighting project is the result of much skillful engineering and extensive experiments. The hospital ward has always offered a difficult problem in adequate lighting that would prove useful to the staff and still comfortable for the patient. The solution of the problem shown will be of widespread interest in these times when one of our most urgent projects is the rehabilitation of the nation's hospital facilities to care for returning wounded service men.

Airport lighting becomes more elaborate as aviation moves ahead. It promises to become a major lighting market. A particularly interesting feature is the extensive use of series circuits where runs are long and units widely spaced. A typical airport lighting layout is shown. Yet, even as this is written, new runway and landing lights, developed under the extraordinarily severe conditions of the far North, are being discussed by illumination engineers.

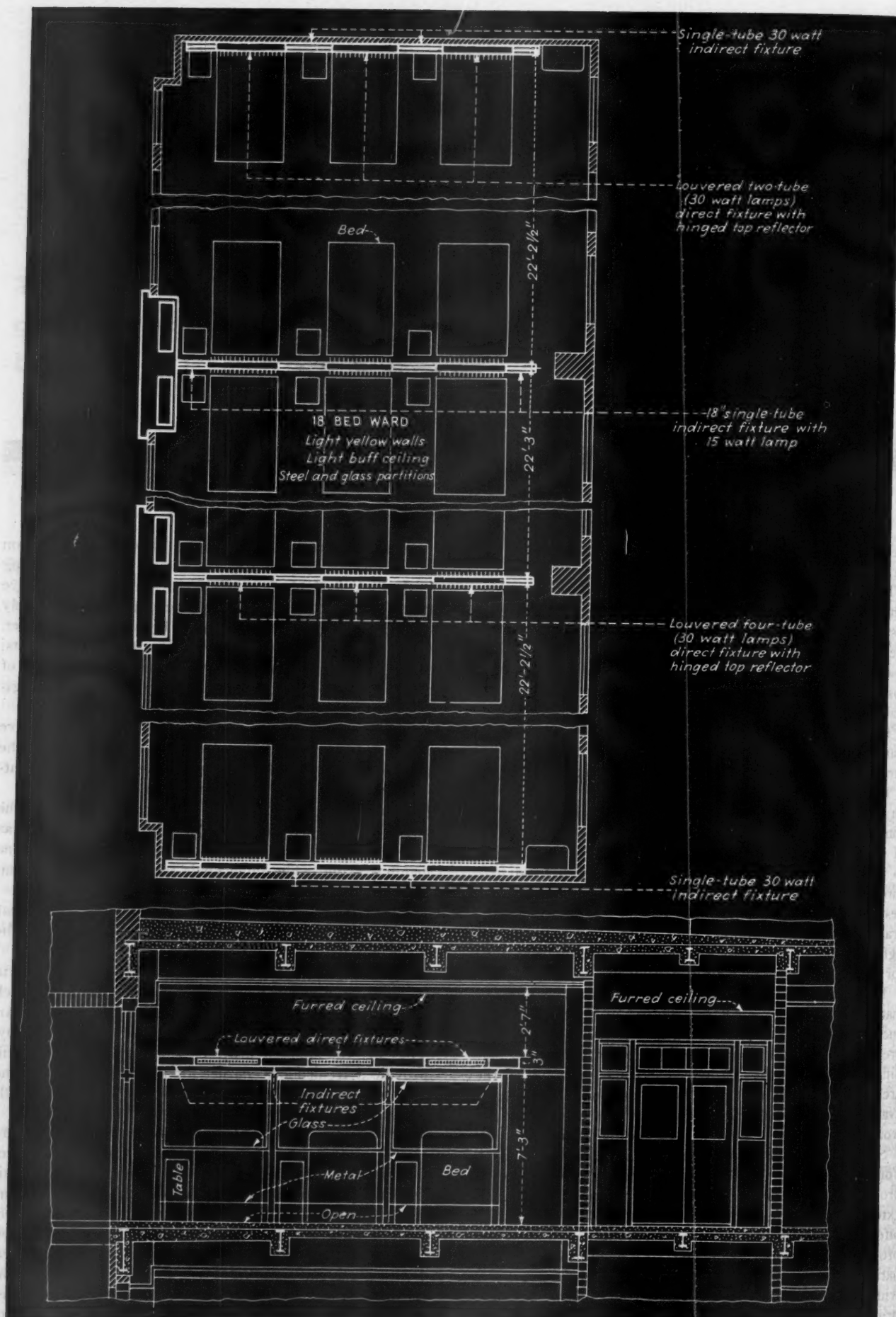
Store lighting promises some unusually attractive opportunities for skillful lighting application. Here the trend indicates a real effort to reduce luminaire brightness and provide "stage settings" for merchandise.

Industrial lighting plans projected indicate that the intensities and methods which have been developed in war plants are going to carry over directly into peacetime manufacturing. The same holds true for offices, with an increasing emphasis on attractive appearance.

Other studies of projects ready for building will appear in following issues of *Electrical Contracting* during the important months to come.

These case studies are not necessarily the ultimate in the lighting program. They are representative jobs which will be executed in the era immediately after the war. They show the practical planning of engineers today. They are the kinds of projects which, after the war, will provide a tremendous market for lighting equipment and wiring. And more important, these projects will provide jobs.

Under current wartime conditions it is still necessary to follow the strict regulations laid down by the War Production Board for industry control. At the close of this section these regulations are clearly reviewed and explained by the Chief of the Lighting and Fixtures Section, Building Materials Division of WPB, Berlon Cooper. An understanding of these regulations is not only important for current jobs but gives a real insight into the problems that may be encountered when they are lifted and the complex mechanism of the lighting industry released.



PLAN AND ELEVATION SHOWING PARTITION AND WALL, DIRECT AND INDIRECT UNITS

Case Study in

HOSPITAL LIGHTING

Eighteen-bed ward installation of fluorescent at Goldwater Memorial Hospital in New York to begin relighting program.

NEW YORK CITY hospital illumination will take a big step ahead in modern lighting design with the proposed postwar installation of direct and indirect fluorescent in its Welfare Island institution. The present design has been the result of an extensive study of all types and classifications of artificial illumination.

The problems in hospital lighting are many and varied. The more important ones are patient safety and comfort, and see-ability by both patient (while reading) and by doctor and nurse during examination and attendance. The one aspect found irritating to most patients was the installation of a fixture in the ceiling in the direct line of vision of the reclining patient. The proposed design solves this problem very nicely in spite of the fact that the basis for the design was not location but eye comfort, see-ability and efficient lighting.

As to the patient's safety, fixtures must be designed of light materials so that at no time shall the patient be subject to the falling of heavy fixture pieces whether of its own accord, or accidentally during maintenance.

Plenty of good quality reading light should be at the

control of the patient from his bed plus sufficient soft indirect illumination controlled by the nurses to permit their work in and movement through the ward during the hours when patients are asleep and direct lights are out.

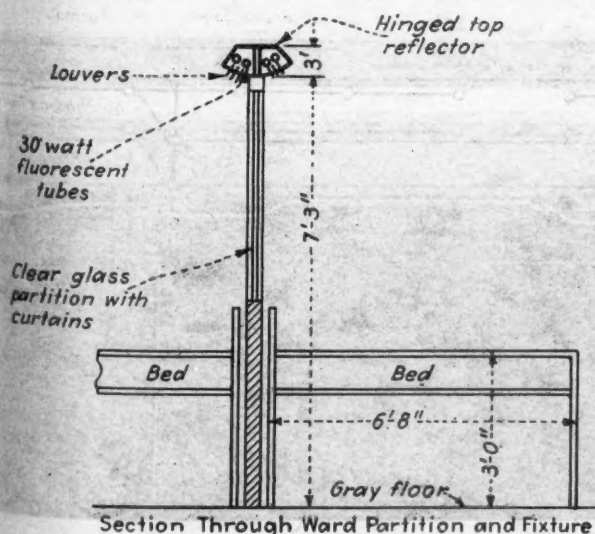
The new design is intended as an answer to these problems; it eliminates irritating and spotty lighting; and contributes a better quality and more efficient illumination.

As shown on the plan, the eighteen-bed ward is divided into three sections by two 7-foot 3-inch partitions of metal and clear plate glass which are curtained to provide privacy. Atop the partition is mounted a continuous strip fluorescent troffer, comprising five 30-watt units and two 15-watt units. Each bed is illuminated by a direct unit consisting of two 30-watt white fluorescent tubes arranged to operate from a dual ballast which tends to minimize cyclic flicker. The direct units are fitted with a top-side hinged reflector and for partition mounting carry four tubes—two tubes above each bed on opposite sides of the partition. For wall units the direct section carries two 30-watt tubes.

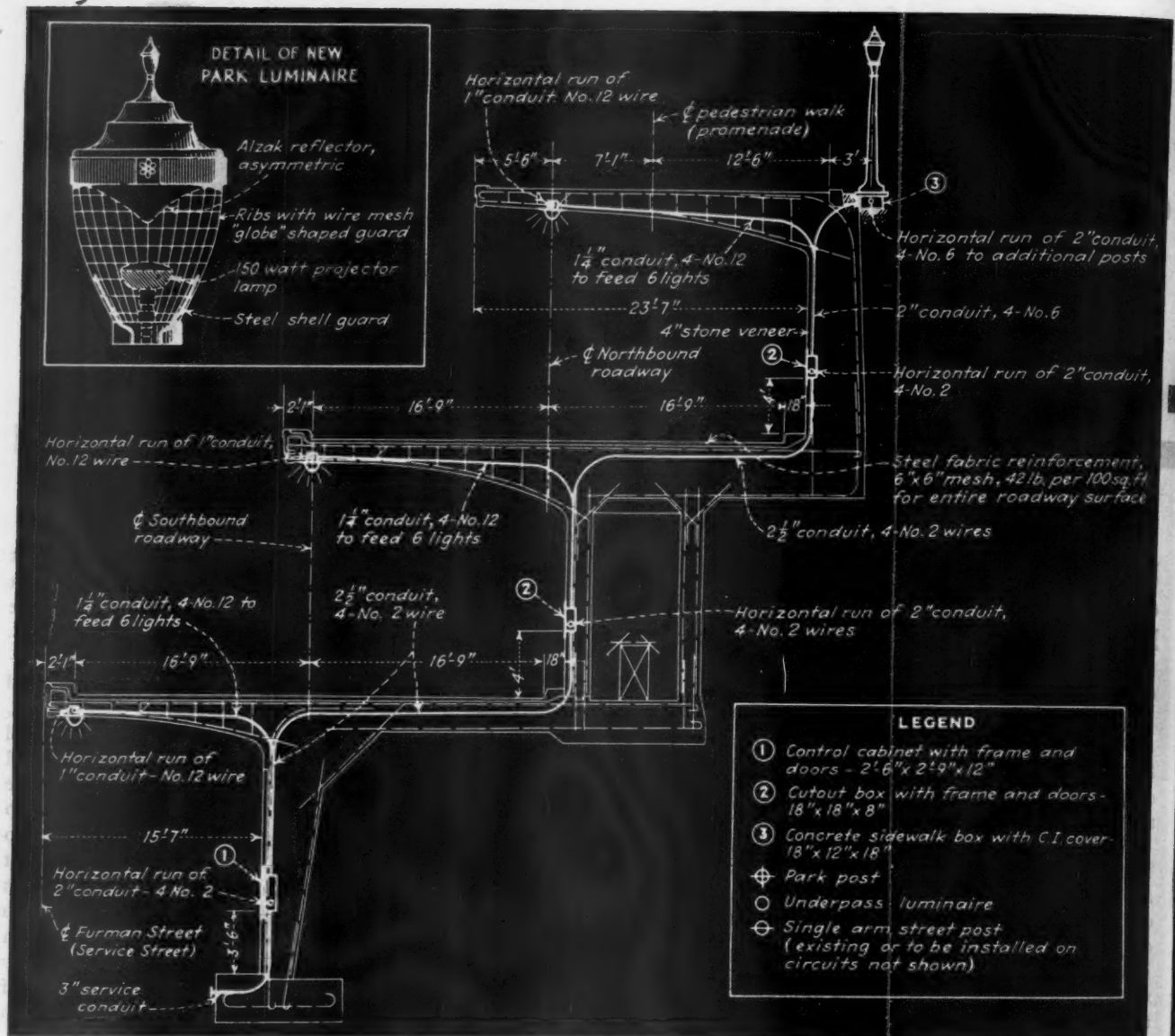
The direct units are louvered to give direct reading light or light for examining the patient at a relatively high level of illumination without disturbing the other patients. The two tubes over each patient are switched on and off at the bedside. The indirect units in between the beds which carry single 30-watt white fluorescent tubes along with the single 15-watt end units provide just enough general illumination for the ward without annoyance to the patients lying in a horizontal position with vision directed to the ceiling. At night all illumination is extinguished with the exception of shielded night lights located above the baseboards and adjusted to throw a faint beam of light on the floor in the aisles.

Further experimentation is to be done after the fixtures have been installed. Plastic louvers of different tints in the direct fixtures will be tested for obtaining improved spectral qualities. Wall, ceiling, floor and partition paints in various contrasting combinations will be tried to obtain the most pleasant and attractive decoration.

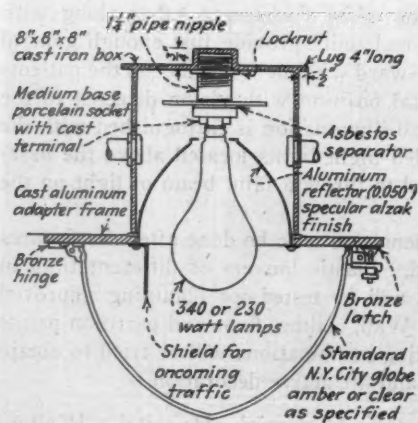
Project: Goldwater Memorial Hospital, Welfare Island, New York City. By: Department of Public Works, Division of Engineering, Bureau of Architecture. A. G. Lorimer, Chief of Bureau; I. Rosenfield, Chief Architect of Hospitals; Albert Lorch, Supervising Electrical Engineer.



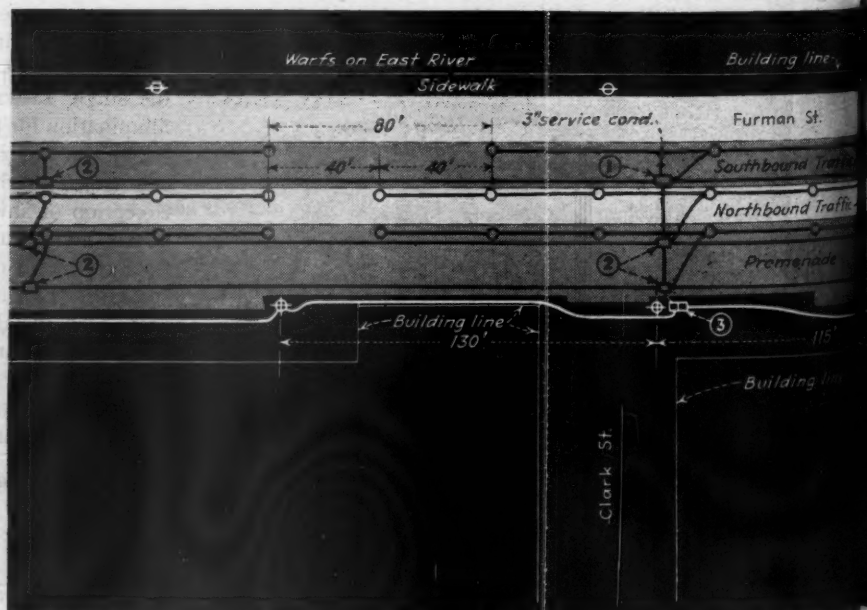
Section Through Ward Partition and Fixture



PLAN VIEW AND ELEVATION SHOWING FIXTURES AND WIRING FOR THE FOUR TIERS OF TRAFFIC.



SECTION OF UNDERPASS LUMINAIRE



Case Study in

STREET LIGHTING

Planned

Lighting

New York City's one and a quarter billion dollar postwar construction program includes an immense amount of outdoor lighting to insure the public's safety against accident and crime.

NEW YORK City's vast postwar construction program includes over 150 separate projects incorporating new street and park lighting with plans being drawn up by private engineers, architects and city departments.

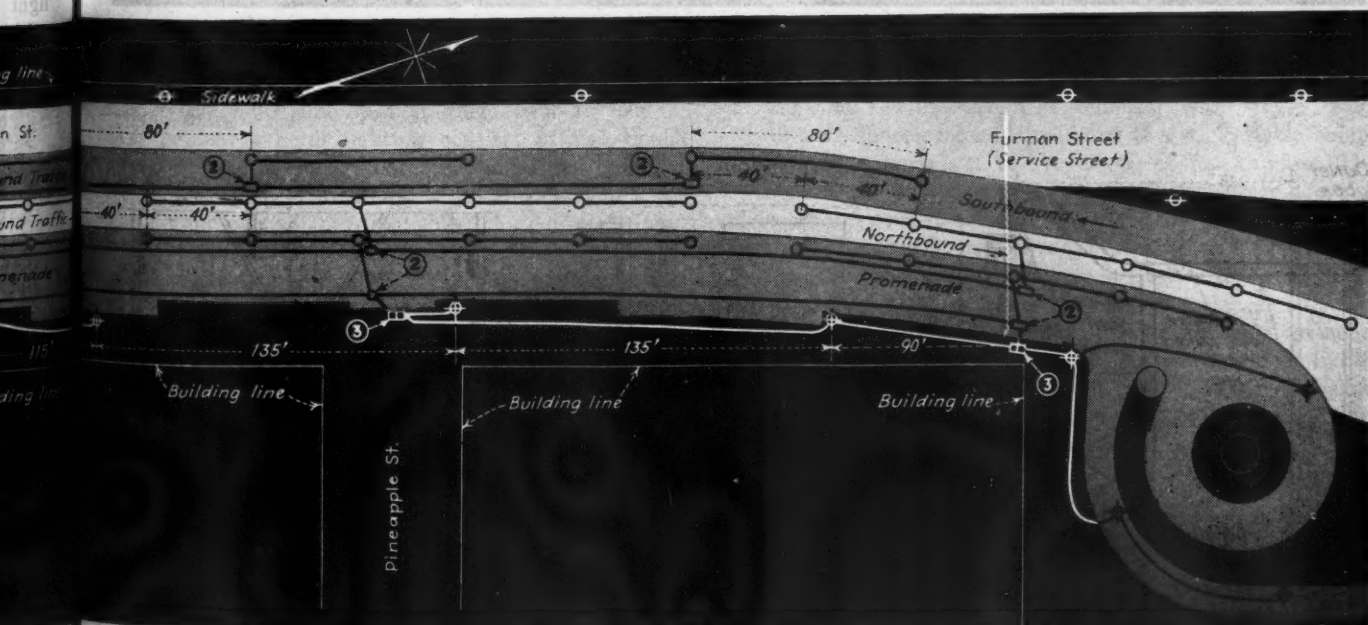
The outdoor lighting includes new park, viaduct, tunnel, expressway and parkway lighting in addition to the conversion of some 2700 miles of street lighting from overhead series pole service to underground multiple service. Thousands of the old style rusted and corroded posts will be replaced by new metal posts of simplified construction and functional design. Flexibility of usage due to interchangeability of the top members permits a lamp post to be changed from a single-arm to a twin-arm or to a mast-arm type of varying overhangs. A new type of "glassless" unit is being contemplated to replace the four panel luminaire, now largely used in New York City parks, thus alleviating a serious maintenance condi-

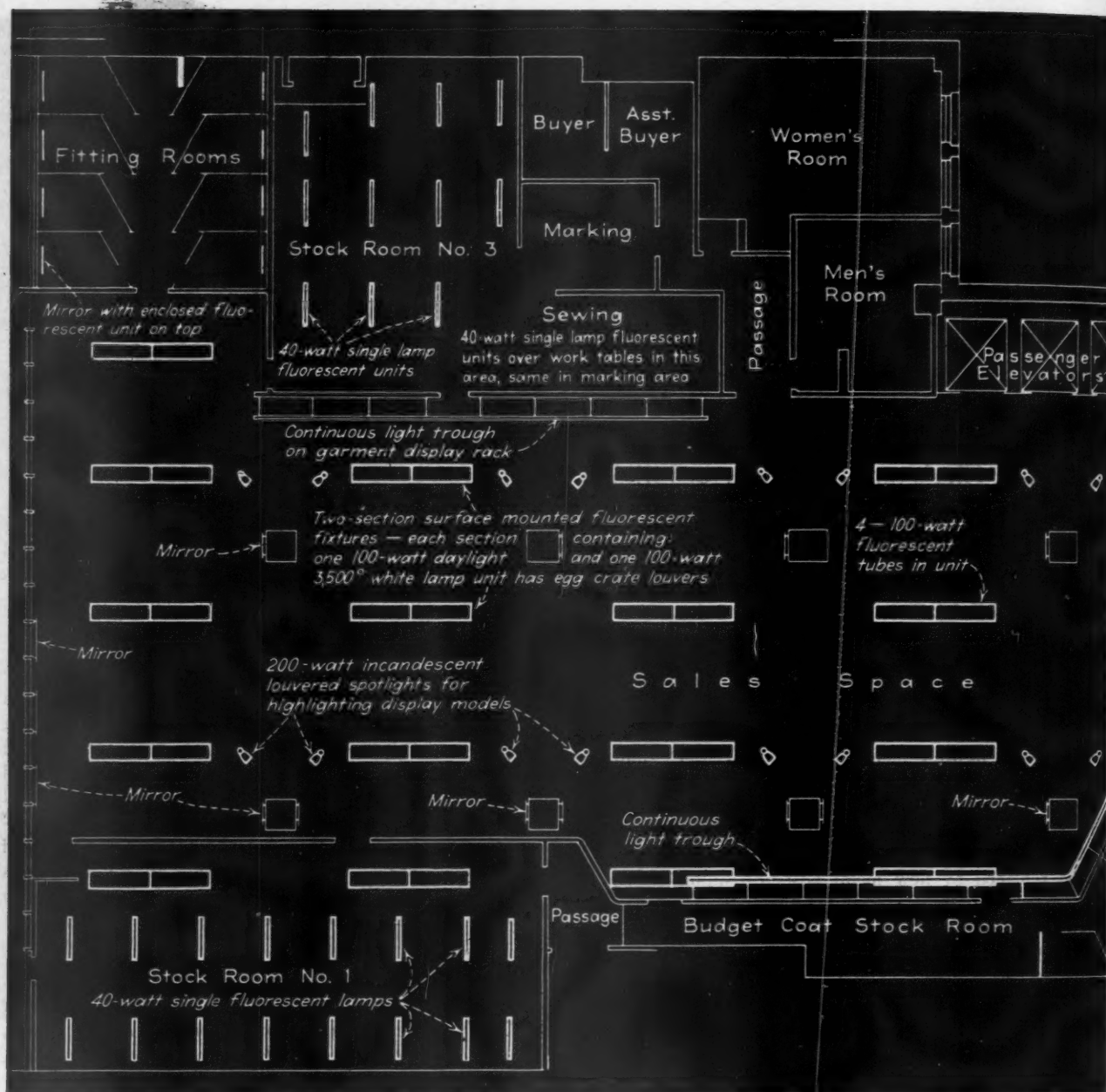
tion caused by vandalism. The new unit will be something on the order of that shown here.

New York City experience has found that by using specially rated incandescent street lamps, more economical operation is obtained. Instead of using a standard 300-watt, 1000 hour lamp to obtain 5650 lumens, a 340-watt, 3000 hour lamp having 5500 lumens output is used.

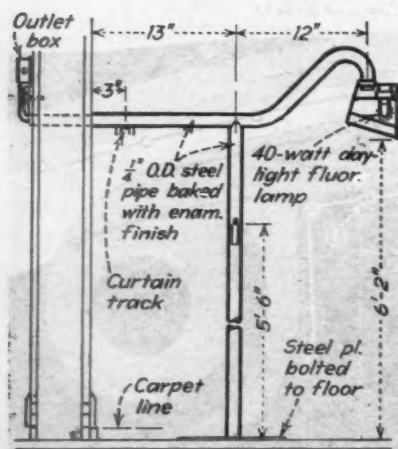
The plans illustrated here are a portion of the Brooklyn-Queens connecting highway showing four tiers of traffic with its attendant lighting. The upper tier, which is a pedestrian promenade is equipped with park post lighting using 230 watt lamps and averaging 135-foot spacing. The second tier is the northbound highway which is illuminated by underpass luminaires provided with 340 watt lamps and located on 40-foot centers. The third tier carries southbound traffic with lighting a duplicate of the northbound tier. The service street, in addition to the underpass luminaires located on 80-foot centers, is provided with standard street posts either existing or to be installed.

*Project: Brooklyn-Queens Connecting Highway.
W. Earl Andrews, Architect and Engineer. Nicholas J. Kelly, Chief Engineer of Light and Power, Dept. of Water Supply, Gas and Electricity, New York City.*

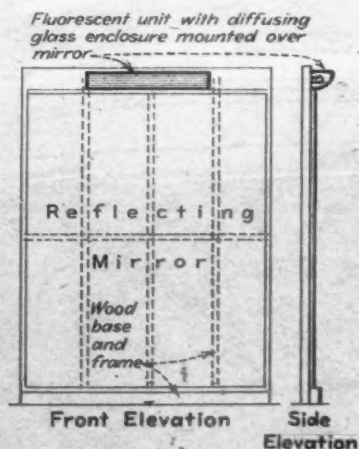




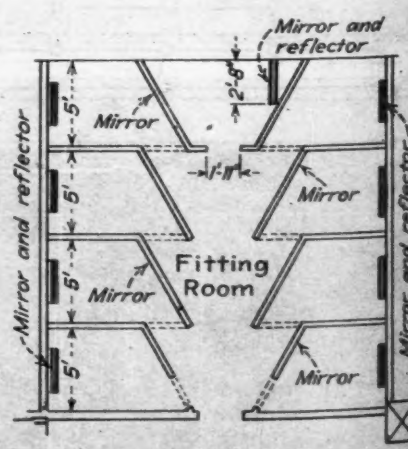
GENERAL LAYOUT OF FLUORESCENT GENERAL AND LOCAL LIGHTING WITH INCANDESCENT SPOTLIGHTING.



DETAIL OF RACK



ELEVATION OF WALL MIRROR



DETAIL OF FITTING ROOMS

Planned

Lighting

Case Study in

STORE LIGHTING

One of Chicago's leading department stores to use fluorescent supplemented by 200 watt ceiling spotlights in lighting rehabilitation program.

RESTRICTIONS on materials during the war put an abrupt end to a rather extensive store remodeling program of the Charles A. Stevens Company, one of Chicago's leading women's apparel stores. Included in the remodeling plans was a complete modernization of the lighting system which was rapidly becoming outmoded. The management was fortunate, however, in having completed one sales area—a suit and coat department—before priorities clamped down. Serving more or less as a test installation over the past two years, the lighting was so well received by customers, buyers and sales personnel, that it will form the basic pattern for relighting the other areas in the store.

The new lighting system combines fluorescent general lighting with fluorescent garment rack lighting and incandescent spotlights for highlighting display models. Its function is to provide a pleasing well lighted sales area with sufficient highlighting to aid customers in choosing merchandise as well as displaying the garments to best advantage.

Supplanting the existing lighting system of one 750-watt, semi-indirect incandescent unit per bay, which provides a spotty distribution averaging about 15 foot-candles, the new general lighting consists of two double-section surface mounted fluorescent units per bay—each section containing two 100-watt fluorescent lamps, one daylight and one 3,500 degree white. An egg-crate louver shields the tubes from the direct line of vision of the customers. The two-section fixtures are mounted in rows on 12-ft. centers and are centered between lateral beams which extend below the 14-ft., 6-in. ceiling. This arrangement provides a cool, evenly distributed illumination of 28 foot-candles over the general sales area.

A unique, simple, economical, and brightly lighted rack is used to display the coats and suits. Instead of the conventional enclosed case with concealed lighting, this rack is of an open type providing a full-view display of the garments for customer inspection. The rack is composed of a 1½-in. baked white enamel finish pipe frame. The top lateral supports (at 5-ft. intervals) are equipped with a continuous trough of fluorescent lighting utilizing a single row of 40-watt daylight lamps. The trough, posi-

tioned 8-inches above and 12-inches in front of the garment hang-rod, blankets the merchandise with 100 foot-candles of cool daylight illumination.

Highlighting of display models at aisle columns and pigeon-hole wall cases for sweaters, etc., is provided by 200-watt, ceiling mounted, incandescent, louvered spotlights—the total number depending upon the objects to be illuminated.

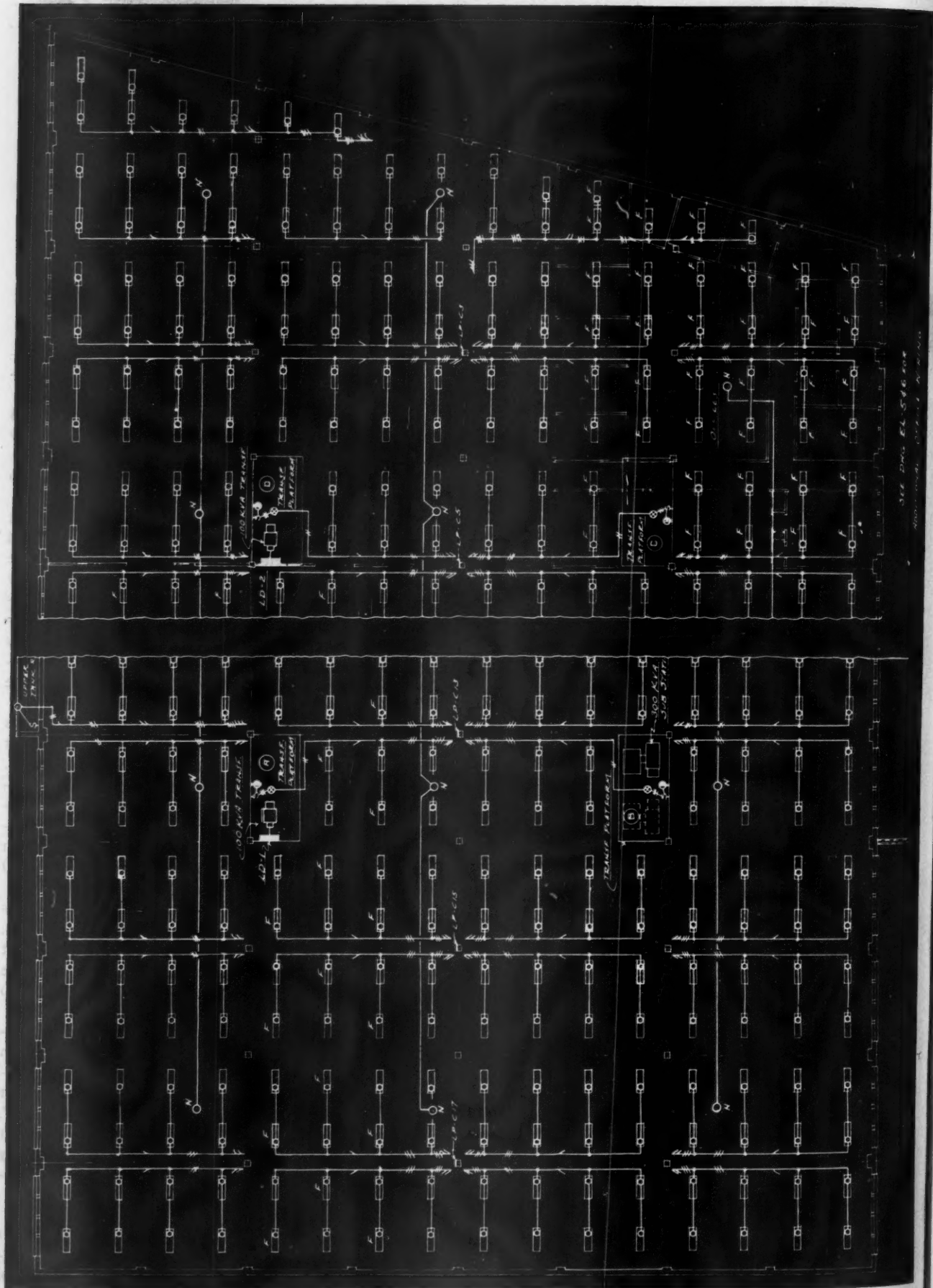
The fitting rooms are equipped with a single fluorescent semi-indirect fixture with a diffusing glass shield mounted directly above a full-view mirror (6-ft., 3-in. above the floor). On an opposite wall installed at a mathematically calculated angle is another full view mirror. This combination permits practically an all-around view of the garment being fitted on the customer. Lighting intensity ranges from 50 foot-candles on the shoulders of the customer to approximately 20 foot-candles at the hem of the garment.

Garment stockrooms immediately behind the sales areas are also equipped with single tube, 40-watt, daylight fluorescent units, primarily for color distinction purposes. Hence, sales help will not have to pick out garments under incandescent light that are displayed under daylight fluorescent illumination. The single tube reflectorless fixtures mounted 6-ft., 6-in. above the floor on 9-ft. centers between rows of storage racks provide 20 foot-candles on the stored garments.

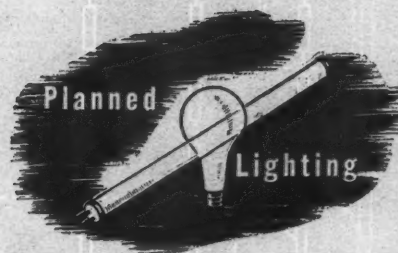
The stockroom areas where alterations are made—marking and sewing—are also equipped with single lamp, 40-watt fluorescent units mounted at a comfortable height above the work area to provide 60–65 foot-candles. The department buyer's and assistant buyer's offices are also equipped with fluorescent lighting.

Plans are now in the "discussion" stage for remodeling three entire floors of the seven story building. Even if the remodeling plans do not materialize 100 percent, lighting on all floors will be rehabilitated to boost existing intensities, and to "sell merchandise with light". The lighting designs illustrated will form the blueprint of the future relighting—specific changes being made only when necessary to fit the individual department or merchandise at hand.

Project: Charles A. Stevens Company Department Store, Chicago, Illinois. Lighting Design by: Skidmore, Owings and Merrill, Architects in conjunction with: Bruce Elliott, Supt. of Maintenance and Construction, Charles A. Stevens Company.



TYPICAL PLAN LAYOUT OF LIGHTING FIXTURES AND DISTRIBUTION WIRING IN THE MAIN PLANT.



Case Study in

INDUSTRIAL LIGHTING

Lighting in the new industrial construction program of Federal Telephone and Radio Corp. to continue at high levels of fluorescent general illumination.

IN planning their expansion program, the Federal Telephone and Radio Corp. intends to continue use of lighting design as installed in their new plants constructed only recently for war production.

The high-level illumination and efficient operation of the fluorescent sources has dictated its selection over other types of industrial lighting. Both management and employees are in agreement that fluorescent illumination is what they want to be installed in future plants. Eye comfort and see-ability are the two important aspects taken into consideration in this industrial lighting design. It has been recognized that insufficient levels of illumination cause needless eye strain with its consequent reduction in employee productivity.

The new buildings to be constructed adjacent to existing facilities in Nutley, New Jersey, will be of one-story construction as shown in the elevation. Each building will contain over 72,000 square feet of floor space with a total of 109 kw. of general fluorescent illumination. The units will be installed in broken continuous rows on eleven foot, three inch centers. Longitudinal centers are twelve feet with a mounting height of sixteen feet.

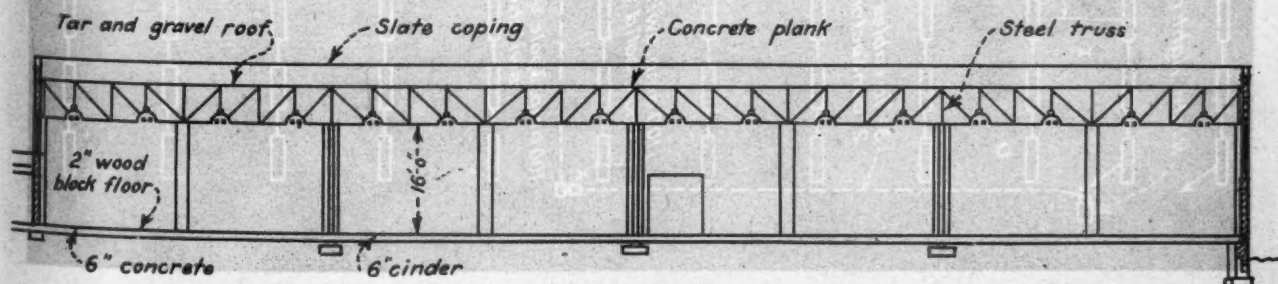
The bottom of the reflector units will be flush with the bottom of the steel truss chords. Each unit will accommodate two 100-watt white lamps.

The high-level, high quality general illumination is supplemented in those cases, such as machine tools, by localized units that will give the proper contrast for easy reading of gauges and dials. Also, in cases where close visual tasks require additional light, local units will be provided to obtain the high levels necessary. Usually, fine work requires from 150 to 250 foot-candles and since the design of the general illumination is to provide a maintained level of 30 foot-candles, the actual contrast ratio falls within the generally accepted value of ten to one.

Feeders at 4150 volts serve the two banks of lighting transformers at central locations in the plant. The lighting distribution feeders are three phase, four wire, 120/208 v. and in turn supply the various 28 circuit (circuit breaker type) panels throughout the plant. The panels are located at every other column down the longitudinal center of the plant. Each circuit controls four fixtures with two circuits per bay.

To insure long life of the circuiting and proper voltage at each fixture, No. 10 Type R wiring will be used throughout.

Project: Federal Telephone and Radio Corp., Nutley, N. J. Architect: Louis S. Weeks. Consulting Electrical Engineers: Clifton E. Smith and Edward B. Silverman. Plant Engineer: Paul Penhune.



Cross Section
SECTION SHOWING MOUNTING OF FLUORESCENT UNITS AT THE TRUSS CHORD LINE.



TYPICAL LAYOUT OF THE GENERAL LIGHTING SYSTEM SHOWING LOCATION OF UNITS.

Case Study in

PLANT LIGHTING

Planned

Lighting

A modern fluorescent general lighting system is a definite postwar project at an automotive plant to meet the requirements of full scale civilian car production.

AN obsolete lighting system will give way to a modern fluorescent installation in several buildings of a Midwestern automotive plant, as soon as materials and equipment are again available. Based on the foresight of a progressive management and the designs of the plant electrical engineer, the lighting in eight of approximately 19 buildings will be stepped up to an average of 26-28 footcandles—more than triple the existing intensity.

Existing lighting in these areas, now operated with skeleton crews for the production of replacement parts, consists, in general, of 200-watt (maximum) RLM incandescent reflectors on 10-ft. spacing and mounted from 9-ft., 6-in. to 12 feet above the floor for 8-10 footcandles.

The new lighting will consist of rows of two-lamp, 40-watt, industrial type fluorescent units—about 3,000 fixtures calculated to cover a total area of approximately 228,600 sq. ft. Plans and specifications call for semi-continuous rows of units on 10-ft. centers with individual fixtures mounted 6-ft., 3-in. center to center. Conduit circuits are to be mounted on messenger cable and equipped with 3-wire, grounded receptacles at each outlet. The fixtures, equipped with a 3-prong, grounded, twist-tight plug and cord for simplified maintenance, are to be chain suspended from the conduit at mounting heights ranging from 12-ft. to about 15 ft. depending upon the

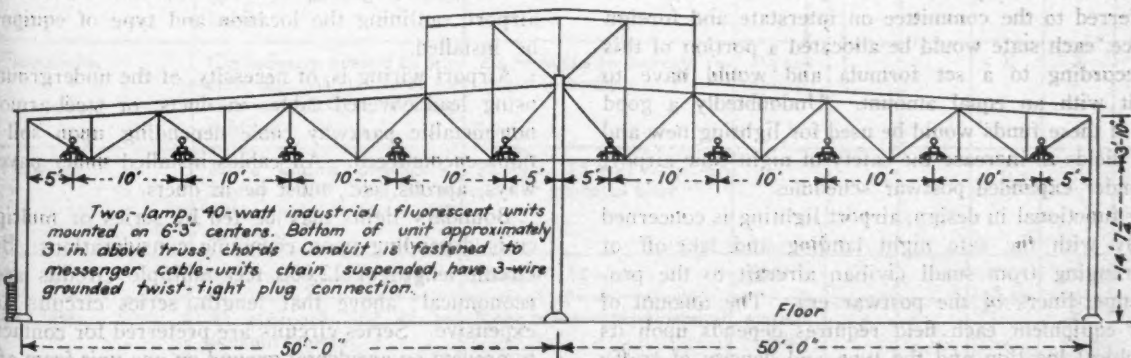
structural conditions of the buildings involved. In all cases the bottom of the units will be about 3 inches above the bottom of the truss chords to provide additional mechanical protection to the reflectors and lamps.

The general distribution scheme will consist of 50 kva. dry type and existing oil cooled, 480/120/240-volt transformers spotted throughout the building; fed from a main switchboard and serving 20-circuit, narrow column type circuit-breaker lighting panels (each with 6 to 8 spare breakers). Circuiting, in general, will consist of eight fixtures per circuit controlled from the panels. Wherever possible, existing feeder conduits will be utilized; some being changed from 220 to 440-volts, others to have new conductors installed in them.

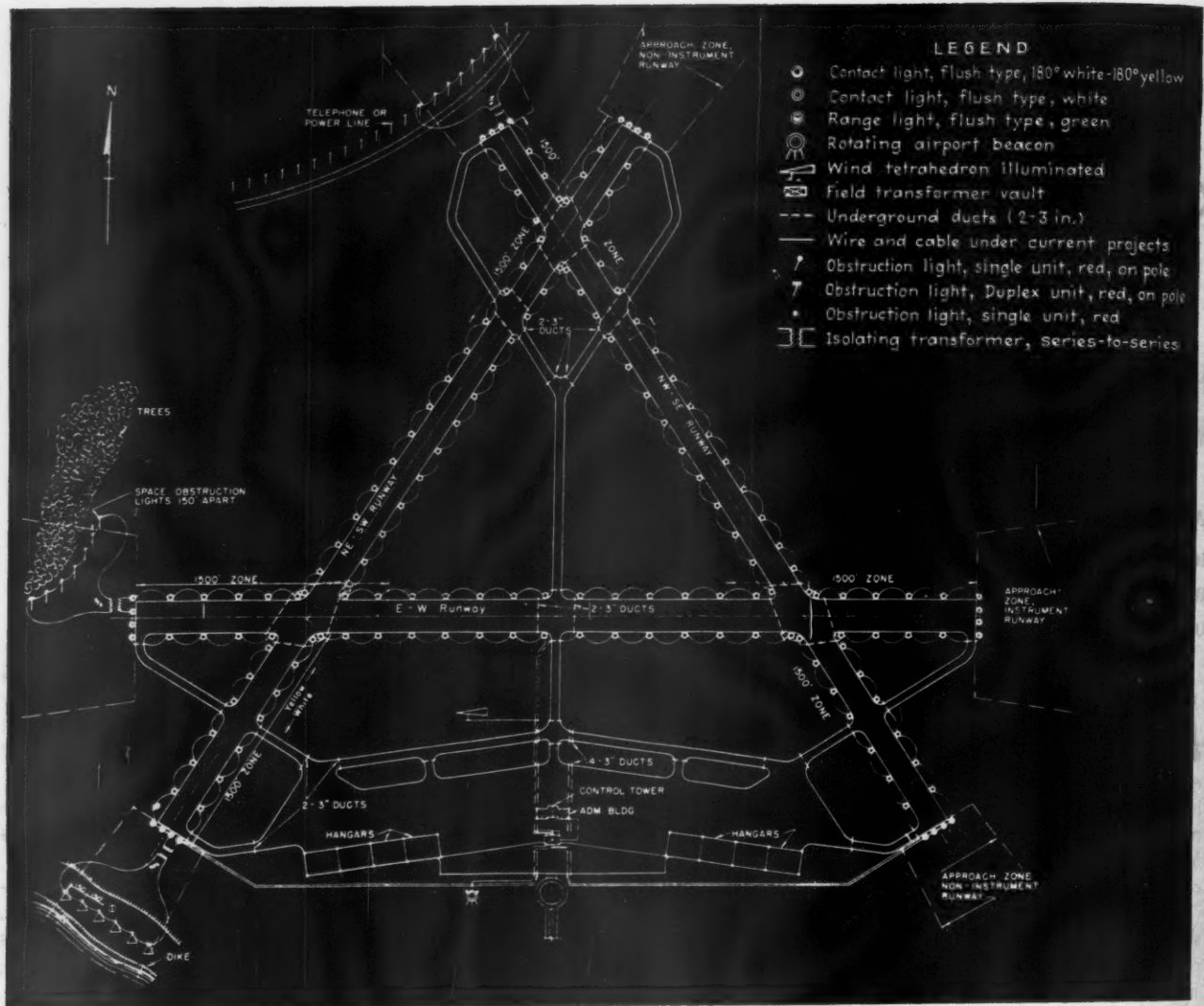
Included in the lighting specifications is a new convenience outlet system for portable electrical equipment. On each column (or at 25-30-ft. intervals where columns are close together) there will be mounted a 3-pole, grounded 20-ampere, 120-volt, twist-tight receptacle. Maximum loading will be six receptacles with each group served by circuits independent of the lighting system.

The new installation will utilize as many existing or rehabilitated feeders as feasible. All branch circuiting will, of necessity, be entirely new construction. The installation will be made as soon as materials and manpower are available with the hope that it can be completed before full scale postwar operations are reached, thereby reducing interruption to plant operation to an absolute minimum.

The proposed installation will be the first step in a postwar program to relight all plant buildings to raise illumination intensity to levels that will be conducive to better production efficiency.



ELEVATION SHOWING MOUNTING OF UNITS ABOVE TRUSS CHORDS



PLAN LAYOUT OF RUNWAY AND OBSTRUCTION LIGHTING

AN important and extensive phase of the postwar lighting market will be in the aviation field—the lighting of airports and the necessary terminal and hangar buildings. The potential is shown by the introduction into Congress, on June 14, 1944, of Bill HR 5024 which proposes an appropriation of 100 million dollars annually for 10 years after the war for the construction of new or the improvement of existing airports and terminal buildings—numbering approximately 3,000 projects throughout the country. Under the provisions of the bill, now referred to the committee on interstate and foreign commerce, each state would be allocated a portion of this fund according to a set formula and would have to match it with an equal amount. Undoubtedly a good portion of these funds would be used for lighting new and existing fields to increase the safety of night-time airport traffic under expanded postwar schedules.

Being functional in design, airport lighting is concerned primarily with the safe night landing and take-off of planes ranging from small civilian aircraft to the proposed super-liners of the postwar era. The amount of lighting equipment each field requires depends upon its geographical location and the type and density of traffic it is designed to handle. Standards for all types of airport lighting, except terminal building and hangar illumi-

nation which is designed to fit the individual structures, have been prepared by the Civil Aeronautics Administration. Such lighting ranges from basic systems—beacon, boundary and obstruction lights and illuminated wind cone—for the small fields to more advanced facilities such as contact, range, taxi and approach lights and runway and apron floodlights for the larger airports.

The C.A.A. has set up five specific classifications into which all airports fall. The table presents the minimum recommended lighting facilities for each classification of airport, outlining the location and type of equipment to be installed.

Airport wiring is, of necessity, of the underground type using lead covered cables in ducts, or steel-armored or non-metallic parkway cable depending upon soil conditions encountered. All cables installed under paved runways, aprons, etc., must be in ducts.

Boundary lights may be fed by series or multiple circuits depending upon economic considerations. Below a circuit length of 12,000 feet multiple circuits are more economical; above that length, series circuits are less expensive. Series circuits are preferred for contact lights to prevent an accidental ground on one unit from affecting the entire circuit. If a multiple circuit is employed, an individual, fused, isolating transformer to feed each light

Case Study in

AIRPORT LIGHTING

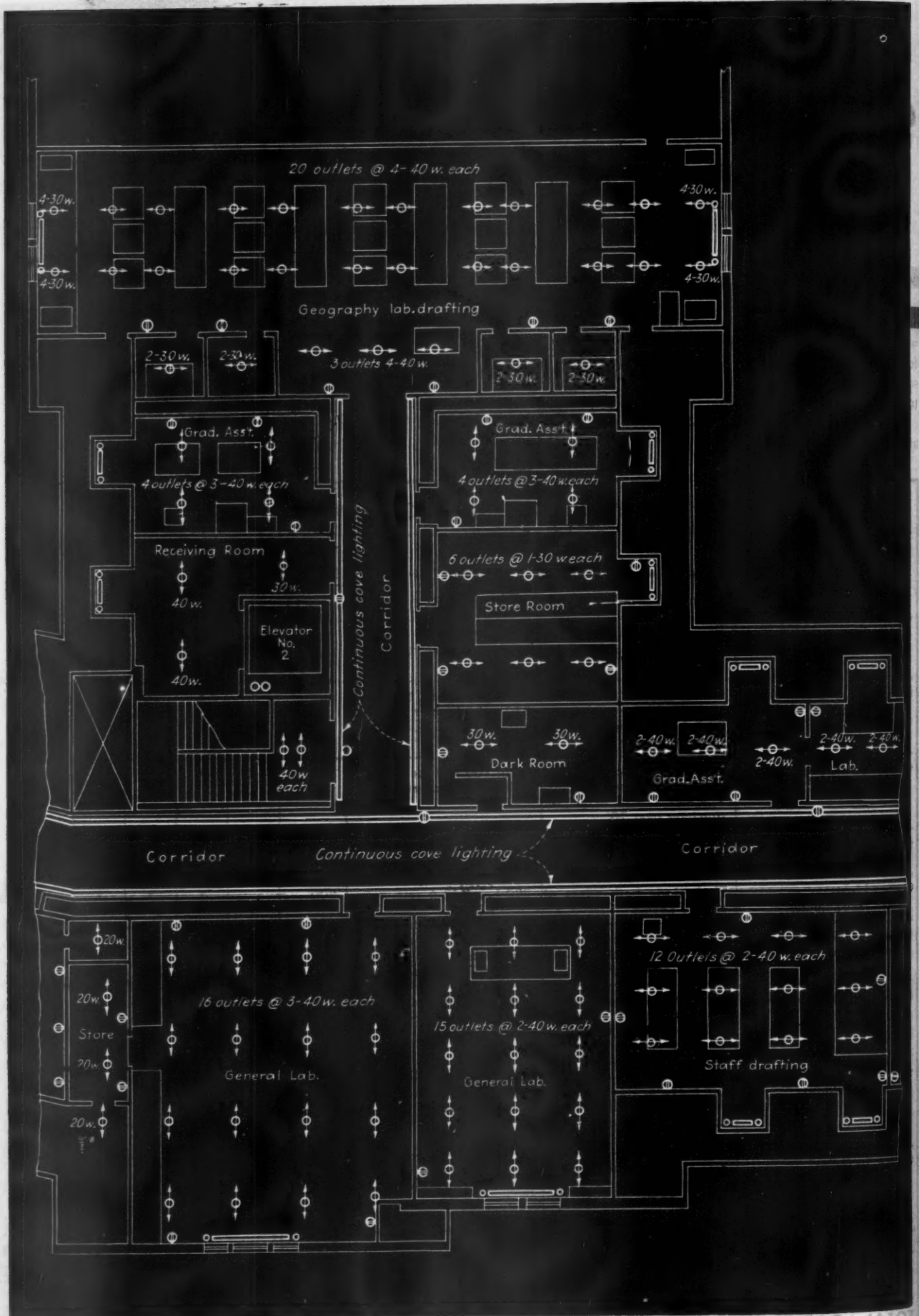
would provide the same degree of safety. Above-ground feeds or extensions on series circuits are made through series-to-series isolating transformers so possible damage to the exposed circuit would not cause total failure.

Because of the distances involved, feeders to floodlights are either 440 or 2,300 volts and terminate in a transformer

for each individual floodlight or group of floodlights with short 32-volt secondary runs to the units. Depending upon the specific design, a single circuit may feed one bank of units with a remote electric-controlled oil circuit breaker at the main switchboard; or it may feed several banks of units with remote controlled contactors at each bank.

C.A.A. AIRPORT LIGHTING STANDARDS

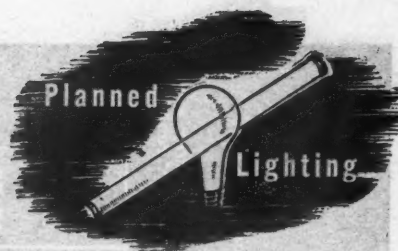
Minimum Recommended Facilities	Location and Mounting	Size of Lamp	Spacing	Airport Classification				
				Class I	Class II	Class III	Class IV	Class V
Airport Beacon	On airport bldg. or tower, within 2 miles of airport at least 50 ft. high	500 to 1500 watts bi-post, pre-focus, 30 or 115 volts	—	X	X	X	X	X
Boundary Lights (incl. range lights)	Outline usable landing area — on boundary cones or flush type along apron or loading platform	15 or 40 watt, 115 volt, 320 or 600 lumen 6.6 amp. series	300'	X	X	X	X	X
Obstruction Lights	On level with or at top of all obstructions near airport, 1/3 and 2/3 of height for structures over 70'	60 or 100 watt for multiple, 1000 lumen, 6.6 amp. series	150'	X	X	X	X	X
Illuminated Wind Cone	On beacon tower, hangar, or other airport bldg. roof	Four 100-150 watt 115 volt lamps with reflector	—	X	X	X	X	X
Contact Lights (incl. range lights)	Flush along both edges of runway paving	320 lumen, 6.6 amp. series	200'		X	X	X	X
Illuminated Wind Tee or Tetrahedron	On ground near landing area — device outlined with red and green lights	25 watt, 115 volt lamps with colored glass globes — or gaseous discharge tubes	—			X	X	X
Landing Area Floodlights	At each end of each runway — outside landable area on either or both sides in banks of 2 or more — 8' min. height	1500 or 3000 watt, 32 volt bi-post or pre-focus base lamps	—			X	X	X
Apron Floodlights	On bldgs. or ground to provide min. of 0.5 f. c. for aprons and 2.0 f. c. for bldg. exteriors	As required to provide required intensity	As required			X	X	X
Ceiling Projector	At a known distance — usually 1000' from observation point — beam 90° upward	35-amp., 12-volt lamp, bi-post or pre-focus base	—			X	X	X
Taxi Lights	Flush along one edge	25-watt, 115 volt	200'				X	X
Approach Lights	At approach end of instrument runway	Neon tubes — experimental	experimental				X	X
TOTAL LOAD IN KILOWATTS FOR VARIOUS SIZE AIRPORTS				10-15	15-20	20-40	40-80	80 up



TYPICAL LIGHTING LAYOUT SHOWING LABORATORY, CLASS ROOMS AND CORRIDOR LIGHTING.

Case Study in

SCHOOL LIGHTING



The proposed new natural science building for Michigan State College will employ both hot and cold cathode fluorescent light sources for general illumination.

WHEN the war is over, Michigan State College, East Lansing, Mich., will have a new natural science building. One of its postwar projects calls for the construction of a four-story structure to house modern laboratory and classroom facilities for students.

The plans and specifications call for the use of conventional hot cathode fluorescent lighting for general illumination of the numerous laboratories, class rooms, drafting rooms and offices. Fixtures for these areas will be of a surface type with a V-shaped louver frame shielding the lamps from view. In general, each fixture will contain two 40-watt, 3,500 degree white fluorescent lamps. For locations where higher intensities are desired and room size limits the number of fixtures, four 40-watt lamps per unit are specified. Spacing of units on the 12-ft. ceiling height (general throughout building) varies with the size of fixture (number of lamps) and the location (small or large room). General lighting intensities in these areas will range from 30-35 foot-candles for class room and laboratories, to 15-20 foot-candles for offices.

Two assembly rooms (for lectures) and one reading room are to be lighted by cold cathode fluorescent tubing as indicated on the plans. In the large assembly room seven recessed louvered parallel troffers combined with a curved troffer, at the rear of the room to provide a calculated

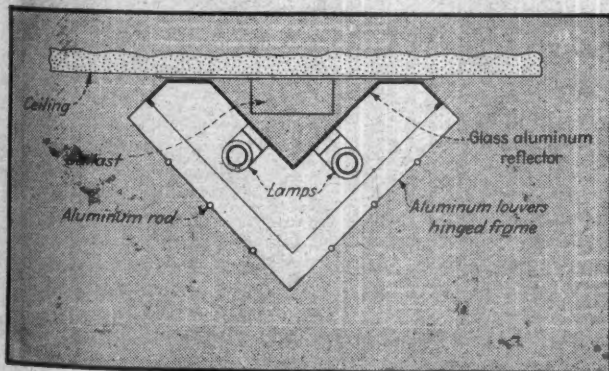
15 to 20 foot-candles of general illumination. Standard eight foot 20 mm. tubes are used with series connection to 120 ma. transformers rated variously at 4000 to 12,000 volts. The blackboard of the lecture platform is to be lighted by eight special-lens-type incandescent units.

In the science reading room, students will study under 30-35 foot-candles of general illumination to be provided by three parallel 56-ft. recessed glass paneled troffers on 7-ft.-6-in. centers—each containing two rows of 8-ft., 20 mm. cold cathode fluorescent tubing (14 lamps total) and fed by two 7,500-volt, 120 ma., transformers.

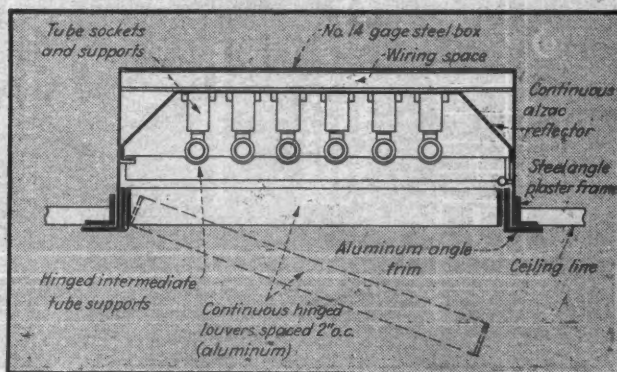
Indirect corridor lighting, averaging 10-12 foot-candles, will be provided by two cold cathode fluorescent coves (one at each side of corridor) each containing two continuous rows of 8-ft., 20 mm., white tubes.

A particularly interesting application of various light sources is specified for the fluorescent viewing room where various mineral specimens will be on public display. The display cabinet is to be equipped with eight fluorescent lamps in special fixtures—four white, one mercury, one black light, one germicidal (ultra-violet) and one Nickel-Cobalt lamp. The lamps are to be automatically turned on and off in accordance with a predetermined cycle to present the minerals under different light conditions. The timing circuit is controlled by two photo-electric cells, one at the entrance and one at the exit of the room. They are so arranged that the case is illuminated when anyone is in the room and is turned out when the person leaves.

Project: Michigan State College, East Lansing, Michigan. Architect: O. J. Munson. Consulting Engineer: Snyder and McLean.



SURFACE TYPE FIXTURE.



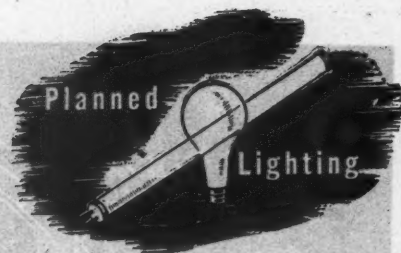
DETAIL SECTION OF TROFFER.



PLAN LAYOUT OF STAGE AND MAIN DINING ROOM LIGHTING. ALSO ELEVATION SHOWING COVES AND SPOTS.

Case Study in

RESTAURANT LIGHTING



By combining medium intensities of ceiling incandescent light and wall fluorescent coving, a quality and quantity of illumination is to be attained for pleasant and comfortable dining.

RESTAURANT illumination is vitally important to pleasant, comfortable dining, and since the restaurateur has come to recognize that external physical comfort is as important to the customer as internal comfort from good food, interior decoration is being given great consideration. The engineer and architect has used in the past, and will use to a greater extent in the future, modern lighting techniques as an integral part of the interior decoration.

As a postwar field of activity for the electrical contractor, this commercial market of public dining rooms, night clubs, cafes, and the like will prove very large since extensive redecoration has been practically at a standstill since before the war.

As an example of this "light architecture" in the commercial restaurant and entertainment field, plans are illustrated here for the new dining room addition to the Hotel Granada, Brooklyn, New York. The complete construction program includes a ballroom addition also, the lighting plans of which are being prepared.

The lighting design of the dining room has been made an integral part of the interior decoration to favorably highlight the architectural scheme. The front of the dining room, which will be finished in steel and glass window plate and decorated with live green foliage, will be flooded by soft white fluorescent light from above. The fixture will be recessed into the hung ceiling and will be continuous across the entire front. Cold cathode fluorescent tubing will be used in standard seven-foot, nine-inch lengths with transformer accessories mounted at the ends of the trough.

The dining area proper will be served in part by a continuous horizontal cove on the two side walls and end wall over the stage. The six vertical side columns will also carry continuous cove from the ceiling down to the top of the leather wall lounges, with a vertical cove on each side of the decorated columns to illuminate wall murals.

The horizontal cove is supported at consecutive points from the side wall and hangs twenty-one inches below the ceiling. Transformers will be mounted at accessible loca-

tions behind the wall with leads brought out through special receptacles.

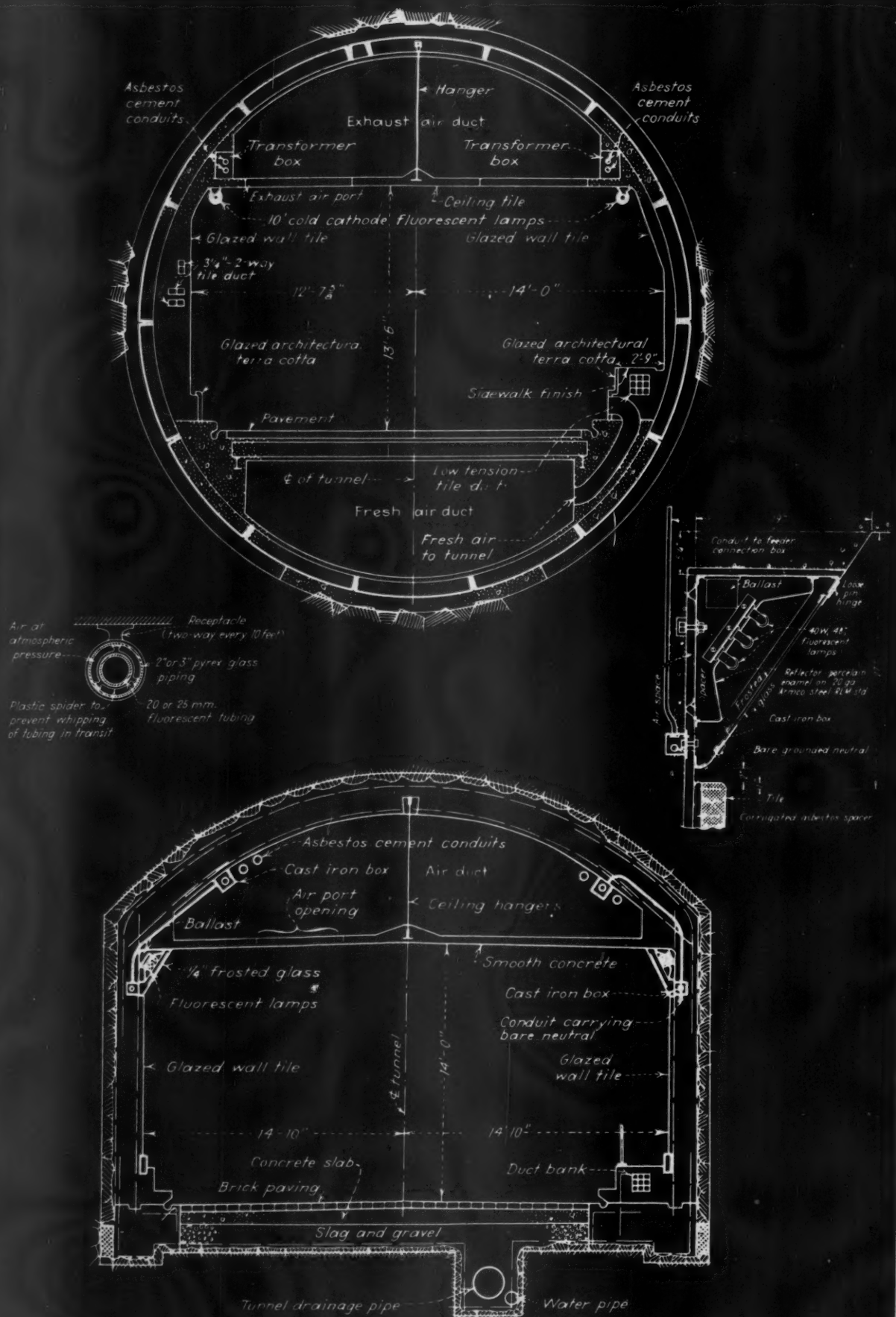
The vertical column coving will be equipped with one standard length cold cathode lamp each. The lamps in the two coves on each column will be connected in series with each vertical column lighting to operate from separate transformers. The horizontal cove along each sidewall will accommodate a single run of tubing, and each total sidewall length will comprise either eight or nine tubes in series and operate from a separate transformer. The end wall coving over the stage will accommodate three single tubes in series and these likewise will operate from a separate transformer.

To supplement the fluorescent illumination, a soft glow of incandescent light will emerge from the center of the two anemostats located in the ceiling over the central portion of the dining room. Each anemostat will carry two circuits of low wattage lamps with each circuit of lamps of a designated color cast. Thus with four circuits, each of a different color cast, along with the soft white of the fluorescent, a number of different blends and tints will be available.

The stage at the end of the dining room is framed with continuous fluorescent cove lighting on the two sides and top. The coving is designed to throw additional light from the sides, and above, onto the entertainers. This stage-framing cove will accommodate a single run of cold cathode standard length lamps and will operate in a series circuit from one transformer mounted back stage and controlled by the operator who also will have control of dimming and switching the stage spotlights.

The major portion of the stage lighting is done with strong reflector spotlights. Besides the two banks of reflector cross spots, a string of reflector-spot down lights are mounted high across the front length of the stage. The cross spots are mounted at the front corners of the stage ceiling. The groups of ceiling spots, mounted at carefully calculated angles, will be placed on separate circuits for control purposes. Each group will be provided with color cast clip-on lenses so that pure color and color blends can be obtained to highlight costumes and accessories of the entertainers. Dimming control will be used on the spots so that varying intensities of spotlight illumination are available.

Project: Hotel Granada, Brooklyn, New York. Designed by: William I. Hohaus, Architect and Engineer.



AT TOP: SECTION OF BROOKLYN-BATTERY TUNNEL. CENTER LEFT: SECTION OF SUSPENDED ASSEMBLY. AT BOTTOM: SECTION SHOWING FIXTURE LOCATION. CENTER RIGHT: SECTION SHOWING FIXTURE MOUNTING.

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Case Studies in



TUNNEL LIGHTING

Tunnel engineers select linear sources for uniform illumination of vehicular tunnels.

TWO lighting designs that are typical for the many tunnels and underpasses scheduled for postwar construction are illustrated in the accompanying plan. One is the Brooklyn-Battery Tunnel in New York City which connects Lower Manhattan with Brooklyn under the point where the East River empties into Upper New York Bay. The other is a metropolitan tunnel which will take through-traffic off already heavily loaded suburban streets.

The problem of lighting tunnels consists of making them attractive and providing gradual transitions from lighter to darker areas.

There are many aspects to the attractiveness problem. Walls and ceilings must be clean and of pleasing appearance. Lighting fixtures must be a compromise between efficiency and easy maintenance. Since walls and ceilings must be cleaned periodically with mechanical rotating-brush rigs, protruding fixtures represent more complicated maintenance. However, flush troffers behind frosted lenses lose a certain amount of light in transmission with a resultant lowered efficiency, in addition to making it more difficult to light both ceiling and walls with desired contrasting intensities. First cost of reflectors and fixture accessories are also determining factors.

Quality and quantity of light also enter into the attractive aspect of tunnel lighting. Incandescent units (previously used) even when installed on short centers have given spotty and non-uniform illumination. The incandescents have, however, provided flexibility in that two lamps could be installed in a fixture with each lamp on a separate circuit, thus giving three levels of illumination.

Different lighting levels are essential in providing gradual transition into and out of the tunnel area. For instance, on a bright sunny day, the first 250 to 350 feet must be high level illumination to allow the driver's eyes enough time to become accustomed to the decrease in the amount of light. Dull days do not require nearly as much "entrance" light as do bright days. These variations of intensity must, for safety purposes, be coordinated with

external conditions, but at the same time be maintained at sufficient levels for see-ability and attractiveness.

In the Brooklyn-Battery tunnel, continuous cold cathode tube is contemplated as shown in the accompanying plan. The fluorescent tubing will be supplied in 10-foot sections (either 20 or 25 mm.) and with special receptacles to carry a Pyrex glass-piping envelope. The purpose of the envelope is for mechanical support and to retain the heat generated to maintain the fluorescent tubing at elevated temperatures (since tunnel temperatures drop quite low) for better operating efficiencies. Transformers will be mounted in the exhaust air ducts. Increased entrance illumination will be provided by approximately 30 kw. of incandescent light graduated down over the first 1000 feet. Power supply will be by means of a series distribution system similar to that of standard street lighting. Primary series circuits of approximately 6 amperes at 5000 volts will be used with series insulating transformers strung along the line to feed from one to five lamps.

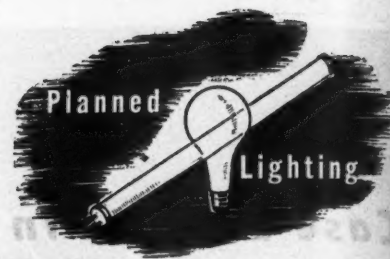
In the other tunnel, standard 40 watt hot-cathode fluorescent lamps will be used in a special fixture as per accompanying detail. Units will be mounted opposite each other on 16 foot, 8 inch centers. Depending on location, two or three tubes will be used, with the highest intensities provided at entrance. Additional illumination control will be provided by the installation of about 30 kw. of incandescent lamps near each entrance for a distance of about 500 feet in, and graduated down. Single lamps (of different wattages) in each fixture will give the required graduation. Power supply will be at 254 volts from 440/254 volt, three phase, four wire, bare grounded neutral feeders.

Experience data obtained from a full-scale model operating under simulated conditions have led the tunnel engineers to believe that illumination from the linear fluorescent sources are the answer to tunnel lighting problems and that the two installations illustrated here will be more attractive, efficient and flexible than heretofore attainable.

Brooklyn-Battery Tunnel: Engineered by: New York City Tunnel Authority. Chief Engineer, Ole Singstad. Electrical Engineer, Leo Geenens.

Regulations for

WAR LIGHTING



Wartime regulations control the lighting industry. In these pages the more important regulations are reviewed briefly as a guide to handling today's jobs.

By Berlon C. Cooper

Chief, Lighting & Fixtures Section
Building Materials Division, WPB

WHILE this article is in preparation, the United Nations are making sensational gains against the enemy, especially in Europe. It is within the realm of possibility that by the time this story goes into print, the European phase of the war will be over. It is intended, therefore, to furnish the lighting industry with information relating to War Production Board orders and regulations, and policies and procedures, currently in effect, which have been designed to assure the availability of fluorescent and incandescent lighting equipment for all essential use. A comparison of these present regulations and policies with previous controls will indicate the extent to which removal and relaxation of controls has already been accomplished.

Lighting During War

It is the responsibility of the Lighting and Fixtures Section of the Building Materials Division, War Production Board, to insure that lighting fixtures and lighting equipment of the proper types and in sufficient quantities are produced to meet the lighting requirements of the military and essential industry, government, and civilian purchasers. The Section has also been responsible for affecting maximum conservation of materials, manpower, and facilities. Conservation of the more critical materials has been effected through the use of substitute materials which were considerably less critical, wherever practical. These responsibilities still obtain and will so long as military requirements and essential civilian requirements continue to exceed the available supply.

The War Production Board has had generous cooperation from the lighting industry in the achievement of these objectives. The industry as a whole is to be complimented on its spirit of cooperation and on its contributions to the winning of World War II.

It is proposed to review herein various current regulations, and to limit comments principally to those controls and regulations affecting the lighting industry.

Production of lighting fixtures is authorized by the

War Production Board subject to the terms of the various applicable limitation orders through an allotment of controlled materials (steel, copper, and aluminum) and by the assignment of preference ratings for the procurement of fabricated parts. This procedure is called the Controlled Materials Plan.

The War Production Board has decentralized its operation wherever practicable in order to enable Regional and Field Offices to resolve industry problems with despatch. Allotments of controlled materials are made to industry from the Regional and Field Offices except for large users. Applications for priority assistance for lighting fixtures are filed with these offices and actions on such requests are taken by them. Answers to questions with respect to all WPB regulations and procedures may now be obtained from these offices. This decentralization effects a speed-up in obtaining materials allotments and preference ratings and in solving individual industry problems. The appropriate industry division in Washington resolves broader problems affecting the industry as a whole and establishes policy with respect to such problems. Field Offices are kept informed on such problems and policies through appropriate instructions.

Limitation Orders

Two limitation orders reviewed herein establish regulations or controls which affect lighting fixture production, or sale and delivery restrictions, or both. Considerable relaxation of restrictions and limitations has already been effected through amendments. This trend reflects changes in the availability of materials or components, based in turn, on changing military requirements.

L-78, Fluorescent Lighting Fixtures, amended April 28, 1944

This order was originally issued April 2, 1942, at which time it was estimated that the sales of fluorescent lighting fixtures were in excess of \$50,000,000 annually, and increasing rapidly. Principal materials used in the manu-

factory of these fixtures were steel and copper. The copper was being used in copper wire leads and for windings in ballasts and transformers. Order L-78 was issued to limit and conserve these materials, and to save tungsten, beryllium, aluminum, and other critical materials used in fluorescent lamps and other components. This order has been amended from time to time to meet various industry problems and changing materials situations.

The current amendment (April 28, 1944) permits the manufacture of all types of fluorescent lighting fixtures except for certain types using single lamp ballasts and ballasts designed for use with 15, 20 and 30 watt lamps. These prohibited types may be manufactured only upon specific authorization of the War Production Board. This limitation was considered necessary to insure the simplification of ballast production. The War Production Board gives consideration to requests for permission to manufacture these prohibited types where it is clearly demonstrated that permitted types of fluorescent or of incandescent lighting fixtures will not meet certain specific lighting requirements.

Hardboard reflectors were used by manufacturers to replace steel when steel was prohibited for reflectors. In early 1944, however, steel became less critical and Order L-78 was amended to again permit steel for reflectors. At the same time, metal weight limits, which had been imposed on fluorescent lighting fixtures early in 1943, were removed. Order L-78 now permits the manufacture of fluorescent lighting fixtures using steel or aluminum without weight limits, except for the prohibited types which may be manufactured only upon authorization of the War Production Board.

Under the current amendment, sales and delivery of all types are restricted to preference rated orders, except for sale on unrated orders specifically authorized by the War Production Board. Such authorization is given either for fixtures reported in inventory as of June 2, 1942, or for fixtures manufactured wholly from materials put in process and components on hand as of April 20, 1942.

L-212, Incandescent Lighting Fixtures, amended August 16, 1944

Order L-212 was first issued March 31, 1943. Principal materials used at that time were steel, copper and glass. Conservation orders prohibited the use of other critical materials, such as aluminum, zinc, copper or brass except for current carrying parts, nickel, chromium, etc. The order has been amended twice.

The original order placed rigid metal weight limitations on residential lighting fixtures, permitting only six ounces of ferrous metal in each fixture. In the current amendment (August 16, 1944), a total of twenty (20) ounces of metal may be used in any individual fixture, and aluminum is now permitted as well as steel. No preference rating is required for sale or delivery of incandescent residential lighting fixtures.

In the original order, incandescent lighting fixtures were divided into three classifications for the purpose of establishing adequate production and conservation control. These classifications were industrial, residential, and utility types. The word "utility" was selected to cover all types of fixtures other than industrial or residential, and included those fixtures nominally classed by the industry as commercial, ornamental, theater and stage, display case, show window, church and other types. Original limitations were in the nature of simplification of types, and metal gauge restrictions.

As metal became more generally available, manufacturing restrictions were removed in order to permit the making of a better product where no increase in labor would result and where unit production could be controlled. Thus, the manufacturing restrictions on industrial fixtures were removed from the order in the March 15, 1944 amendment and were relaxed on the utility types. The current amendment removes manufacturing restrictions on all types of incandescent lighting fixtures except residential.

Sales on all incandescent lighting fixtures except residential are limited to preference rated orders in the current amendment. These sales restrictions apply to all incandescent lighting fixtures except residential, regardless of when manufactured.

Preference Ratings for Lighting Fixtures

Any person desiring to purchase lighting fixtures or lighting equipment may do so if he has an adequate preference rating to apply to his purchase order. In general, preference ratings are assigned by the War Production Board to any business which qualifies for such a rating by being engaged in the production of some military or essential civilian item, or to any business engaged in an essential public service or repair activity, when a need for new lighting or relighting also can be established.

Preference ratings are assigned in two ways. First, ratings are assigned pursuant to an application for preference assistance made on an applicable form. These forms are WPB-541, WPB-542, WPB-547 and WPB-617. Each form is discussed separately below. Second, blanket MRO (maintenance, repair, and operating supplies) ratings have been assigned by the War Production Board through regulations. These regulations state who may use blanket MRO ratings, and establish certain restrictions and limitations on the use of these ratings. These regulations were issued in an effort to simplify the procedures to be followed in purchasing items for maintenance, repair and operating supplies by outlining in the regulations the criteria that would be used by the WPB in processing a preference rating application. These regulations authorize the use of specified preference ratings upon the certification of the purchaser that he is complying with the terms of the regulations. Blanket MRO ratings are assigned by such regulations as CMP Reg. 5, CMP Reg. 5A, CMP Reg. 9A, and certain orders in the "P" series. Some of the regulations named are discussed separately below. Priorities Regulation 3 gives the rules for the use of preference ratings and is discussed separately below from the standpoint of its effect upon the use of ratings for lighting fixtures.

Limitation Orders L-78 and L-212 permit the sale and delivery of new fluorescent or new incandescent lighting fixtures or parts on orders bearing preference ratings. Order L-212 permits sale and delivery of incandescent residential lighting fixtures on unrated orders. It also permits sale and delivery of parts to be used solely for repair of an existing fixture on a blanket MRO rating of AA-5 or higher. Order L-78 permits the sale and delivery of parts to be used solely for repair of an existing fixture on an unrated order. Both Order L-78 and Order L-212 state that an order or contract bearing a preference rating lower than AA-2 must be regarded as an unrated order if the rating is a blanket MRO rating. This means that only blanket MRO ratings AA-1 and AA-2 are valid on orders for complete* fixtures. Any rating assigned on

Forms WPB-541, WPB-542, WPB-547, or WPB-617 is a valid rating for the purchase of lighting fixtures.

Preference ratings currently in effect in the order of their precedence are as follows: AAA, AA-1, AA-2, AA-2X, AA-3, AA-4 and AA-5.

Before filing an application for preference assistance, a purchaser should first review the applicable regulations which assign blanket MRO ratings to determine if such a rating as he requires is available to him. If he determines he is eligible to a valid MRO rating, he may apply it to his purchase order upon certification as required by the regulation, or as required by PR-3. If a valid blanket MRO rating is not available to him, he should make application to the War Production Board for a preference rating on the appropriate application form, usually WPB-541 or WPB-617.

Blanket MRO Ratings

The following regulations assign blanket MRO ratings. Each regulation is discussed separately from the viewpoint of its applicability to the purchase of lighting fixtures.

Priorities Regulation 3, amended August 22, 1944

This regulation states the rules for the use of preference ratings, what kind of purchase orders or services may be rated, and how a rating may be put on an order. It also places restrictions on the use of ratings and includes a "List B" of products for which blanket MRO ratings may not be used. In general, this regulation should be consulted before using a rating whether the rating was obtained directly from the War Production Board or from a customer.

PR-3 states, "Blanket MRO ratings may not be applied to get any item on List B, except as permitted by the list." List B of PR-3 includes the following: "Lighting fixtures, fluorescent (as defined in Order L-78), and incandescent (as defined in Order L-212), and electric floodlights. Blanket MRO ratings of AA-2 or higher may, however, be used". This regulation further states, "A blanket MRO rating means a rating assigned by CMP Regulation 5 or 5A, or by any other War Production Board regulation, order (including an order in the "P" series), form or certificate which assigns a rating for maintenance, repair or operating supplies without specifying the kind and quantity of the material to which the rating may be applied."

In view of the listing of fluorescent and incandescent lighting fixtures and electric floodlights in List B of PR-3, an order for these products bearing a blanket MRO rating lower than AA-2 must be regarded as an unrated order.

Priorities Regulation 19, Farm Supplies, amended May 6, 1944

This regulation provides that a farmer may issue a certificate to his supplier certifying that he is a farmer and that the supplies covered by his order are needed now and will be used for other than household purposes in the operation of a farm. A farmer's order for lighting fixtures supported by a certificate is the same as an order rated AA-2X. However, these are technically not preference ratings, and hence suppliers may not extend them. Dealers or other suppliers selling lighting fixtures to farmers on certificates should obtain priority assistance to purchase their own inventories on Form WPB-547. The priority equivalent to AA-2X assigned to farmers

by this regulation for lighting fixtures is not a blanket MRO rating and is, therefore, valid for use under Orders L-78 and L-212. Since preference ratings are not required for incandescent residential lighting fixtures, a farmer may purchase these fixtures for farm or home use without regard to certification or preference ratings.

CMP Regulation 5, Maintenance, Repair and Operating Supplies, amended May 18, 1944

Blanket MRO ratings of AA-1 or AA-2 may be applied to orders for lighting fixtures by any business listed in Schedule I or Schedule II, respectively, in this regulation. Lighting fixtures may be classed as "minor capital additions". The regulation states: "Minor capital additions may be obtained under the procedures provided for in this regulation (CMP Reg. 5) for obtaining maintenance, repair and operating supplies where the cost of the minor capital addition does not exceed \$500 (excluding the purchaser's cost of labor) for any one complete capital addition. . . . Where the capital addition involves construction, authorization to construct must be obtained to the extent required by Conservation Order L-41, or by any other applicable order or regulation of the War Production Board."

Blanket MRO rating AA-5 assigned by this regulation to businesses not listed in Schedules I or II may not be used to purchase lighting fixtures. This rating is voided by Orders L-78 and L-212 and by PR-3.

CMP Regulation 5A, Maintenance, Repair and Operating Supplies for Governmental Agencies and Institutions, amended May 30, 1944

Any activity or service listed in Schedule I of this regulation is assigned a blanket MRO rating of AA-1, and any activity or service listed in Schedule II is assigned a blanket MRO rating of AA-2. These blanket MRO ratings may be used to purchase lighting fixtures as a "minor capital addition". This regulation provides that the cost of such addition, excluding the purchaser's cost of labor, shall not exceed \$100. AA-5 blanket MRO ratings assigned to any activity or service not listed in Schedules I and II of this regulation, may not be used to purchase lighting fixtures. Governmental agencies and institutions purchasing lighting fixtures with MRO preference ratings must not exceed their overall MRO quota. If construction is involved, authorization to construct must be obtained to the extent required by Order L-41 or by any other applicable WPB order or regulation.

CMP Regulation 9A, Parts and Materials for Repairmen, amended April 15, 1944

This regulation assigns a preference rating of AA-3 with a V-3 symbol to be used in purchasing materials and parts under this regulation to anyone in the business of making repairs. This preference rating and symbol may be used by a repairman to purchase parts of an incandescent lighting fixture to be used solely for the repair of an existing fixture. It may not be used to purchase complete new lighting fixtures, nor for parts for fluorescent lighting fixtures.

WPB Assigned Ratings

When a person is not entitled to a blanket MRO rating with which to purchase lighting fixtures under any of the regulations, or when quantities exceed the limits or quota, he may make application to the War Production

Board for priority assistance. Appropriate forms have been developed for that purpose which are discussed separately below.

Form WPB-541, Application for Priority Assistance

This form should be used when no construction limited by Order L-41 is involved. (See discussion of Form WPB-617 for definition of construction.) The applicant should fill out the form in detail, and in addition, should furnish complete information about his present lighting and wiring system, why it is inadequate, and why the proposed lighting has been selected.

Generally, it is necessary to establish two facts in order to obtain WPB approval of a WPB-541 application: (1) the applicant's relationship with the war program and the essentiality for his business or service; and (2) the necessity for lighting or relighting.

WPB-541 applications should be filed with the nearest Field Office of the War Production Board. All Field Offices are delegated authority to take action on these applications, and where necessary can have representatives visit the plant or establishment of the applicant to obtain first hand information and to make an on-the-spot analysis of the lighting problem involved.

Form WPB-542, ANMB Preference Rating Form

This form is used by the Army, Navy, Maritime Commission, British Purchasing Commission and Lend Lease countries. It is mentioned here since orders placed with applied ratings obtained on this form are available to suppliers of lighting fixtures.

Form WPB-547, Distributor's Application for Preference Rating

The wholesale and retail trade uses this form to apply for a preference rating to be used on orders for lighting fixtures or for component parts for lighting fixtures which will be placed in inventory for resale. Applicants must furnish all information called for on the form, and file the form with the nearest WPB Field Office.

Preference ratings assigned on WPB-547 may be used to purchase any type of lighting fixtures which are permitted to be manufactured by Orders L-78 and L-212, but will not be considered as justification by WPB to authorize the manufacture and assembly of types of fixtures prohibited by these "L" orders. Wholesalers and retailers are required to sell all lighting fixtures held in inventory in accordance with the sale and delivery restrictions of all applicable WPB orders and regulations. Ballasts and lampholders obtained with ratings assigned on WPB-547 forms must be sold as such. They may not be assembled into a new lighting fixture by the wholesaler or dealer without authorization under CMP.

Form WPB-617, Application for Authority to Acquire or Construct Facilities

When construction restricted by Order L-41 is involved, an applicant must file Form WPB-617 and furnish all data called for on this form, including any additional data requested under "Instructions" on the form itself, depending on the types of project involved.

Order L-41 as amended August 19, 1944, includes Interpretation 9 which makes the following statement applicable to lighting fixtures. "Paragraph (b) of L-41 describes the kind of work which is covered by the order under the term construction. It specifically states that 'the installing of equipment or fixtures' is construction and is

covered by L-41. This means that if a piece of equipment or a fixture is attached to a building and used as a part of the building, or if a piece of equipment or a fixture is so firmly attached to the building that removal would result in material injury to the building or the fixture, construction under L-41 is involved and the limitations of L-41 apply." This interpretation further states, "The installation of any piece of equipment or fixture which involves putting new wiring in a building [is construction under L-41]."

Order L-41 permits construction which does not total more than certain dollar limits over a period of a year for certain types of construction without obtaining permission under this order. This order should be referred to by the applicant for the cost limit exemptions and other restrictions outlined in the order.

Except for certain types of applications listed under "Instructions" on Form WPB-617, these applications are to be filed with the nearest Field Office of the War Production Board.

Schedule A of CMP Regulation 6 establishes construction limitations applying to construction authorized by the War Production Board on Form GA-1456 resulting from application made on Form WPB-617. This form is used generally in authorizing agricultural, commercial and industrial construction, and also in granting priorities assistance needed for these types of construction. In the current amendment to CMP Regulation 6, Schedule A dated August 7, 1944, no limitations are placed on the use of lighting fixtures and equipment except on "exterior lighting [which] is prohibited except when mounted on buildings."

On an application involving a new building project, the application is reviewed from the standpoint of adequacy of facilities of the type of project involved. On an application involving relighting, the application is reviewed from the standpoint of adequacy of the present lighting system, and from the standpoint of the relationship of the applicant's business to the war program. No distinction is made by WPB between fluorescent and incandescent lighting in reviewing applications. Authorizations will be made on Form GA-1456 which will also assign a preference rating and an allotment symbol. The applicant may then apply this preference rating and allotment symbol to his purchase order covering the type of lighting fixtures required by him for the project.

Since an applicant is not required to describe the lighting fixtures which he proposes to use when filing Form WPB-617, it may be that authorization will sometimes be made for a project in which the applicant has selected types of fixtures prohibited by an "L" order. The assignment of a preference rating obtained pursuant to an application made on Form WPB-617 will not be considered as justification for the authorization of the manufacture of prohibited types of fixtures. The applicant should, therefore, select fixtures of fluorescent or incandescent types which are permitted to be manufactured. If he has some special lighting application which cannot be solved adequately by the use of types of lighting fixtures which are permitted to be manufactured, he should furnish his supplier with a statement of the necessity for the prohibited types. The manufacturer can use this statement in requesting authorization to manufacture the prohibited type. If the manufacturer is authorized to make the prohibited types of fixtures, the applicant may then place his order with the manufacturer and use the preference rating assigned to him.

EDITORIALS

W. T. Stuart, Editor

Electrical Adequacy Is a Real Value

Until modern mechanical features in the home can receive appropriate valuation in mortgage appraisals, adequate wiring will have to compete with minimum standard jobs. It can and will. But it is high time that appraisers recognized the substantial value that good wiring contributes to a home. Though two homes may be structurally identical, one may be electrically modern and the other obsolete. Ordinary appraisal practice would give them the same valuation.

Electrical and mechanical features are increasingly important in modern living. They represent substantial sums of money and it is safe to predict that they will involve much larger percentages of the building dollar in the years ahead.

The National Adequate Wiring Bureau has done some splendid work in bringing the story of adequate wiring before residential appraisers. Let's hope that, when building gets under way again, the electrical facilities will be valued in line with their actual worth.

The Contractor Is the Hub

In a discussion of programs for the development of the vast commercial market, after the war, league executives, meeting in Detroit last month, were inclined toward the attitude that

1) the problem offers many difficulties for league action because of the great variety of jobs and the competitive situation between contractors, and

2) the programs should be instigated by the electrical contractor groups in the various local leagues if full industry cooperation is to be achieved.

Fair enough—but it should be emphatically asserted that in any industry program toward the full development of the commercial wiring and lighting market the contractor must be the hub

of the campaign. The plan must include not only the cooperation of the contractor, but his active and aggressive participation with the full knowledge that the entire organization is behind him.

In commercial building and modernization, adequate wiring is essential before any other aspect of electrical modernization can take a step. The lack of adequate wiring is a ball and chain on the whole industry which can defy the cleverest promotion and the most skillful selling. We can always sell gadgets. But if we are going to sell electrical living, and we must, then good wiring must come first.

One of the most successful electrical development activities in the country is that of the North Central Electrical Industries in Minneapolis. The hub and core of their program is the Minnesota Electrical Council, a contractor group. That is significant. It should be pondered by everyone concerned with building postwar electrical markets.

Buildings Should Be Retired

The powerful forces of tradition, land laws, property rights and sheer inertia leave every city and town with a heritage of obsolete, ugly and unsafe buildings. Some have been reduced to slums and there is enough plain viciousness associated with them to get public action here and there. But what we need is a comprehensive plan of building retirement, a device by which buildings can be torn down or replaced before they have a chance to destroy community values.

We do not underestimate the enormous difficulties of law and equity that would have to be solved. But the sooner the building industry and enlightened civic leaders go to work on the problems the sooner solutions will be found.

And in the days after the war, when public opinion is in a state of flux and

new concepts of community rights rise out of wholesale population shifts, there may be a unique opportunity to open the way to keeping our cities alive and modern.

Radio Interference

A Michigan contractor at a recent meeting posed a question that deserves a wider audience because it is important and it is of very real concern to all of us. He wanted to know what steps we ought to take in cooperation with the radio manufacturers to solve the problem of radio interference.

In the days ahead, if we get only a small fraction of the predicted electronic gadgets and conveniences, when we have television and high fidelity radio, the problem of interference from lights and small motors can become much more critical than it is today. Uncle Joe's electric razor might be a minor annoyance on the morning news broadcast, but on television it could be intolerable.

There is a real need for an exchange of views and information between the manufacturer of electronic equipment and our industry toward the design and installation of wiring and apparatus that will not interfere and the use and application of filters to localize interference at the source.

For Better Street Lighting

Compared with the progress made in interior illumination in the past twenty years, street lighting is seriously static. There is urgent need after the war for a concerted program to build up street lighting systems and bring them up to date in intensity and effectiveness. There has been plenty of progress in light sources and luminaire design. But they cannot serve the public until they are more widely used

and installed according to modern concepts of proper illumination.

Street lighting, from the standpoint of public safety alone, is one of the cheapest of municipal services. The effect, in taxes, of very substantial improvements would be small. There is hardly a community in the country which cannot modernize its street lighting to great community benefit. Check with your civic leaders today. Is modern street lighting a part of your community postwar plan?

And Other Unusual Equipment

A northwestern contractor is doing a large business in small air compressors to the rural trade. Investigation brought out some interesting data. A well equipped farm may have as many as 50 pneumatic tires to keep inflated. The compressors are also used for spraying orchards and painting.

And electrical drills are among the first items of electrical equipment the farmer wants as soon as he "gets the lights" on his rural line. Rural electrification is opening the way to many new and unusual sales opportunities for the electrical industry. The farm market is different in many respects from others. It combines the characteristics of ordinary residential wiring and wiring in a small industrial plant. And labor saving devices are, not luxuries or gadgets, but vitally essential production tools. It is a market with great possibilities for continued development after the war.

The Farmer Buys a Welder

It is pretty hard to associate electric welding with agriculture. Yet some electrical contractor-dealers in the middle west are reporting a lively business in small welding rigs. The buyers are farmers.

It all comes about through the greatly expanded use of farm machinery. New equipment is scarce, old equipment is wearing out and needs frequent repair. Repair shops are distant, understaffed, and besides there is no time or help to haul awkward machinery to town. So the farmer buys a welder and makes his own repairs on his own farm.

Here is a market opportunity that can have substantial prospects for profit and customer good will for those contractors serving the farm market.

Coordinating Air Conditioning

The first meeting of the Indoor Climate Institute, a new organization devoted to the many aspects of air conditioning, was held last month in Detroit. It brought together men from a number of related industries to talk about a joint approach to the postwar market.

I.C.I. and its plans and progress will be closely followed by electrical industry groups. The whole field of indoor climate is so closely allied with electrical development in adequate wiring, apparatus and load building that there is bound to be a strong community of interest. A strong organization with a vigorous campaign for automatic heat and air conditioning will drive customers our way, too.

Defining The Wholesaler

Maryland electrical contractors have provided wholesalers in that area a complete list of all licensed master electricians in the state in an effort to stop sales at wholesale prices to other than legitimate buyers. It is part of a comprehensive program to bring order into the distribution of electrical products in that area.

In defining a wholesaler, they have clearly outlined a basis for clear cut policy—"a firm whose total electrical business is the sale of electrical commodities at wholesale to dealers for resale; to electrical contractors; to railroads; to federal and state governments and municipalities; to public utilities; to industrial companies which regularly maintain an electrical department; and manufacturers requiring electrical materials in the fabrication of their products only."

Wholesalers willing to cooperate with the rest of the industry and their best customers will find in that definition substantially their own policies. Those who go beyond their own customers to sell direct to the consumer are not wholesalers and should not receive consideration as wholesalers in dealing with manufacturers.

Washington Notes

► The sweeping advances in all theaters of war is forcing rapid action in all Washington bureaus toward preparing for the day when Germany folds up. The President's recent order, according to some observers, was long overdue. There is a feeling that Washington is as ill prepared for peace and its impact on the nation's economy as it was for the realities of war on December 7th. Hurried assurances now that strong measures are under way are signs of near panic in some quarters.

► WPB will probably remove practically all restrictions on civilian production as soon as the German phase of the war ends. W.M.C. controls will also be relaxed and a substantial change in rationing will be forthcoming.

► Acting Chairman J. A. Krug of WPB has outlined a simple program for X day. (1) All limitation orders and material conservation orders that can possibly be removed will be stricken from the books. Some controls, however, will have to be held; cotton textiles, crude rubber, tin, lumber, some chemicals and a few other items. (2) To protect military production, military programs will be given a priority rating. The AAA rating for emergencies, military and civilian will be retained. This is equivalent to a motorcycle escort through traffic and is an over-riding priority. WPB does not intend to program civilian production. Industry division and advisory committees will be maintained, however, and will be prepared to step into emergencies.

► Some of Krug's recent statements have been heartening to private business, as, for instance, "Where there are plenty of materials, there is no excuse for government control over their distribution. We can safely entrust the details of planning of reconversion to the individual corporation, the individual business man and the individual worker."

► Four "spot" authorizations for civilian production have started the reconversion process: Electrolux Corporation of New York, vacuum cleaners; Electrical Products Consolidated of Spokane, Washington, metal signs; Heating Assurance, Inc., Spokane, Washington, stokers and the Johnson Company, Houston, Texas, septic tanks.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

PORTABLE IGNITRON MAINTAINS VOLTAGE

INDUSTRIAL

A portable Westinghouse ignitron rectifier rated 300 kw. and used to supply power and maintain good d.c. voltage regulation has been put into service at the Reitz Coal Mines in Central City, Pa.

The complete unit has been assembled onto three mine cars to facilitate movement into the mine and to permit quick change in location. Transformers, circuit breakers, ignitrons, switches, cooling systems and all auxiliary equipment is included to make the three car unit completely portable. The circuit breakers are of an air-break type and the transformers are air-cooled to eliminate oil and fire hazards.

As soon as the unit is located at the approximate mine load center, a bore hole is drilled to drop a 2300 volt, 60 cycle, three phase cable to the ignitron air-cooled transformers. The ignitrons convert energy to 275 volts d.c. for the trolleys and other electrical equipment

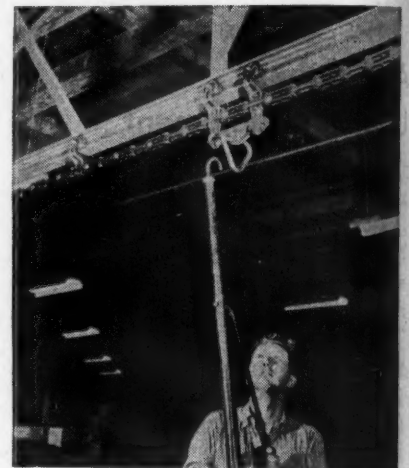
As the mine progresses and the load center shifts, the unit can be quickly moved to a new location with only a short interruption of electric power.

ELECTRIFIED CONVEYOR MOVES MATERIAL

INDUSTRIAL

A 1600-foot continuously moving overhead chain conveyor now moves incoming raw material and assembly items with greater dispatch and efficiency than ever before through the main receiving depot of the Glenn L. Martin Company plants in Baltimore, Maryland.

The conveyor itself consists of a drop-forged, rivetless chain supported by an I-beam track. Turns are equipped with ball bearing steel rollers spaced on four-inch centers to carry the chain around the arc of track curvature without undue strain. Two types of trolley attachments are used to ride the I-

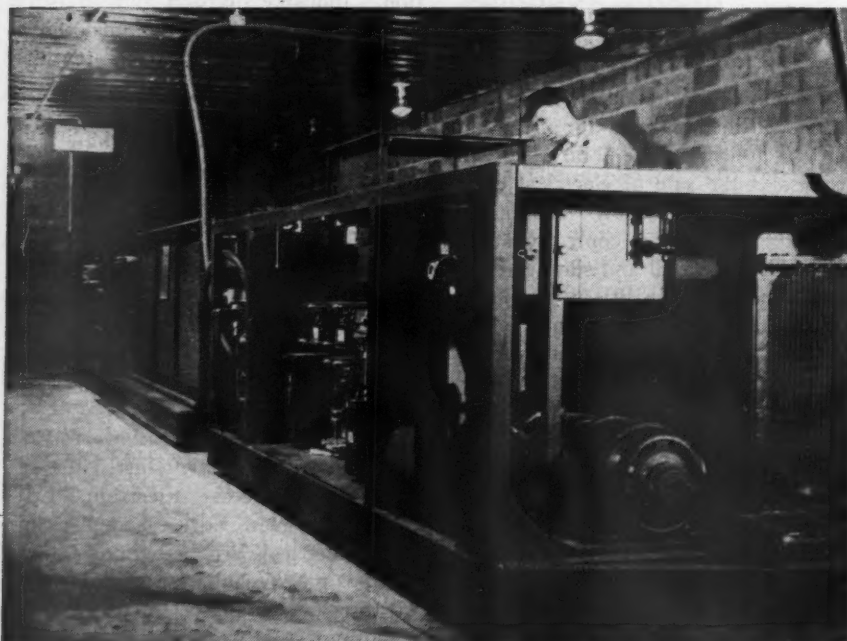


TELESCOPIC MAST being raised to hook into load ring of conveyor trolley. Note that load-carrying trolleys use a double bracket with four wheels while the chain carrying trolley attachments are single bracket units.

beam, carry the chain and pull the trailers carrying incoming material. The one type, of which there are 48 spaced approximately 25 feet apart are used only to carry the chain. This attachment is nothing but a single-forked bracket supported by two trolley wheels. The second type, of which there are 16 spaced at 100-foot intervals consists of a double set of forged brackets connected by a load bar supporting the triangular load ring. This can be seen in the accompanying photograph.

The floor trailers are hooked onto the conveyor by means of telescopic masts which engage the load rings on the trolley attachments previously described.

The four-inch trolley wheels are equipped with ball-bearings and rubber tires for smooth and easy operation. Each load trolley and trailer can carry a maximum of 2000 pounds. The chain is driven by a variable-speed caterpillar drive, operating at a definite speed for any given loading within a three-to-one speed range (25 to 75 feet per minute). Power is supplied by a $7\frac{1}{2}$ hp., 1800 rpm., motor rated for three phase, 60 cycle, 440 volt operation.



WATER-TO-AIR heat exchanger system for cooling the rectifier tubes is seen at right. Incoming-2300 volt service to rectifier transformer is at back left.

No. 5 of a series
by SYLVANIA
for all users of
fluorescent lighting

Fluorescent operating hints



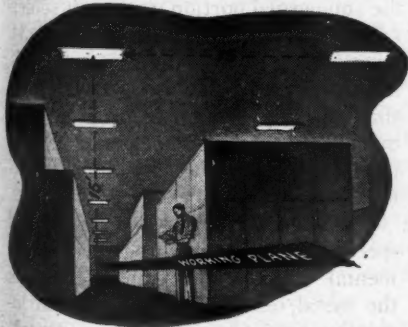
HOW TO GET THE RIGHT LIGHT FOR THE JOB

The lighting engineer plans illumination according to the work it lights. He can do much to help you get the right fluorescent light for top visual efficiency.

Size of lamps, spacing of fixtures, color of walls and ceiling, mounting height, size of area — all these factors determine intensity of illumination. The amount of light at the *working plane* is measured in *foot-candles* by means of a lightmeter.

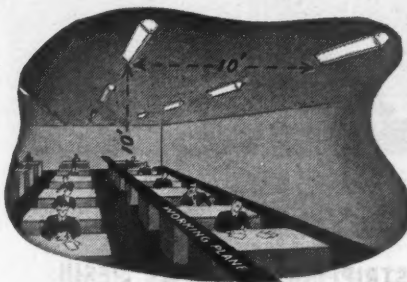
TYPICAL INSTALLATION EXAMPLES

Based on Recommended Minimum Standards of Illumination by the I.E.S. (Illuminating Engineering Society)

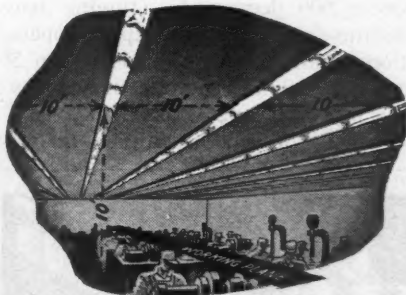


Ten foot-candles of illumination can be used for some types of rough assembly, molding clay products, tanning leather, grinding grain, general indoor

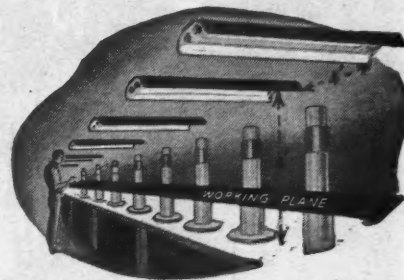
construction, lobbies, corridors, elevators — lighting for traffic safety. Individual industrial fixtures spaced 15 feet apart, as shown at left, give this level in a typical stockroom.



Thirty foot-candles are needed for top efficiency in office work. This intensity of light also is recommended for sugar and flour grading, medium bench work in machine shops, photo-engraving blocking, hand casting in type foundries, warping dark woolens, and press-rooms. Individual shielded commercial fixtures are arranged here to give this illumination in a typical office.



Fifty foot-candles give adequate light for many types of fine assembly work, fine glass grinding and polishing, inspection, silk and cotton warping, stitching light materials, and automobile assembly. Continuous row of fluorescent fixtures at this height above a bench will do the job.



One hundred foot-candles of light are concentrated on this inspection bench for checking 1/10,000 of an inch tolerances. This high level of illumination also is required for such painstaking jobs as tint-laying in engraving, watch manufacturing, fine proof-reading, and show windows in secondary business districts. Close spacing of fixtures, as shown, pays in better work.

When you plan special fluorescent installations, avoid too much brightness contrast between localized bench lighting and the general lighting system. It makes for eye-fatigue and a drop-off in efficiency. For example, if 100 foot-candles are needed at a specific inspection bench, there should be about 25 foot-candles of general illumination in the rest of the room. This suggests a 4 to 1 rule of thumb.

MORE DETAILED INFORMATION—FREE

This folder contains a chart of I.E.S. Recommended Minimum Standards of Illumination for more than 200 different kinds of work — fluorescent priority information — cases of how the right fluorescent light for the job helps industry — tips on obtaining better lighting from your present fluorescent installations. Yours for the asking. Just write to Sylvania, Boston Street, Salem, Mass.



SYLVANIA

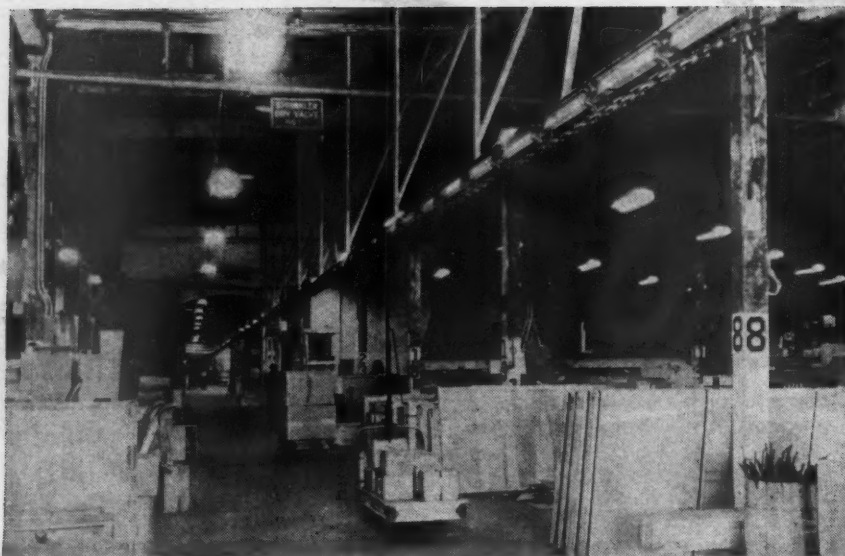
ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

Electrical Contracting, October 1944



LOADED TRUCKS move down the main aisle of the warehouse through the inspection area where the many different items are segregated for dispatch from the interplant transportation section.

The conveyor runs along the railroad platform, turns 90 degrees and runs the length of the truck delivery platform, turns once again and enters the warehouse passing down the main aisle through the receiving station, inspection area and inter-plant transportation area, and finally returns to the railroad loading platform.

The incoming material is first removed from freight cars and trucks and loaded on to the trailers which are then attached to the conveyor. At the receiving station the trailers are disconnected while receiving reports are recorded. They are again attached to the conveyor and continue on to the inspection department and on to the inter-plant transportation area from which point received materials are dispatched.

STRIPPING SYNTHETIC RESIN INSULATION FROM FINE WIRE

WIRING

A simple method of stripping the resin insulation from Formex wire, used by Fairchild Camera and Instrument Corp. in their manufacturing processes, has been developed by Fairchild engineers for the finer wire sizes Nos. 36 to 44. It involves the use of only two chemical solutions and although accelerated by heat, all operations are carried out at temperatures under 600 degrees F. (tinning temperature). Each lead stripping operation is now completed in less than 30 seconds with a resultant estimated saving of 50 percent in manhours.

Since the good qualities of this

resinous insulation are toughness, flexibility and resistance to solvents and heat shocks, its assets have been turned into liabilities insofar as stripping is concerned.

Most prior methods of stripping were found by Fairchild engineers to materially weaken the mechanical strength of the wire, especially in the smaller sizes. These methods (while successful on larger diameter wires) consisted of removing the insulation by scraping with knife, abrasive cloth or rotating wire brush; by burning over a gas flame; or by dipping in high temperature solder. Certain other hazardous methods were found in use which involved operations in concentrated acids, hot caustic solutions and the like. The latter methods constituted potential danger sources to both the operator and the wire.

The hot solder stripping-tinning method, formerly the most successfully used, was simple and quick; however, the operation required use of 1000 to 1100 degrees F. solder which stripped and tinned in the same procedure. The disadvantages in this method, however, were rapid oxidation of the solder, embrittlement of the wire, charring of the resin above the stripped and tinned section, and especially the necking-down of the tinned wire due to the copper being driven into solution with the solder by the accelerating effect of the required solder temperatures. All these disadvantages are especially detrimental to the finer sizes of wire, and the necking-down is especially critical. As an example of its detriment, No. 40 wire takes about three seconds to tin while only two seconds will dissolve the submerged portion using soft solder (40-60) at 1050 degrees F. No. 34 wire completely dissolves in approximately eleven seconds. Wires finer than No. 40 cannot be used in this method since they do not have the stiffness to break through the surface tension of the solder.

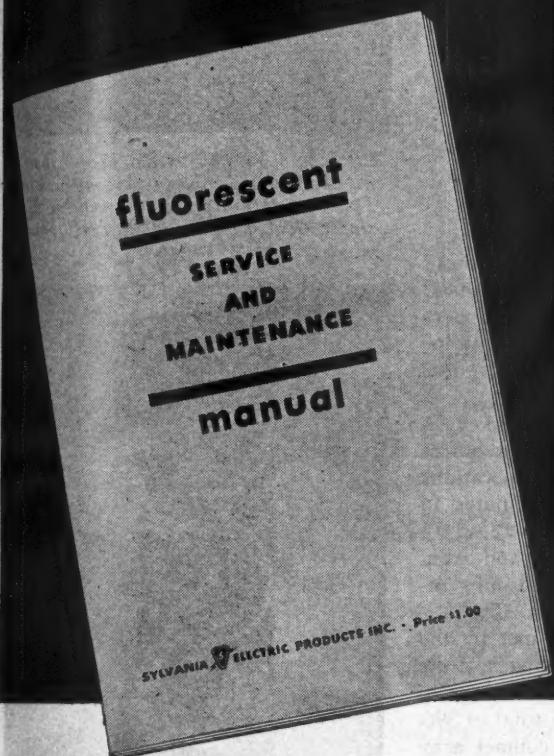
The Fairchild process was developed specifically to avoid these three detrimental effects: (1) embrittlement of the metal, (2) charring the resin insulation, and (3) dissolving and necking-down the copper. At the same time it has incorporated simplicity, speed and minimum handling.

The process involves use of two chemical liquids. The first operation consists of dipping the leads to the desired depth into the first solution which is maintained at 425 to 450 degrees F. This first operation takes place under a vented hood to remove a slightly unpleasant odor. Dipping time required varies with wire size being about five to seven seconds for Nos. 40 to 44 H.F. (heavy Formex) wires and eight to ten seconds for No.



MOBILE UNIT substation rated 2500 kva, 13.2/26.4/52.8 kv. to 2400/4160 Y/7200/12,470 Y volts and built by General Electric on a 12 wheel trailer is used for an emergency unit to move to any location on a distribution system.

FREE HELP TO SELL FLUORESCENT AND *keep it sold*



NEW FLUORESCENT SERVICE

AND MAINTENANCE MANUAL—This complete and authoritative handbook helps to solve service and maintenance problems in fluorescent installations. Prepared by Sylvania's Commercial Engineering Department, an advance copy of this \$1 handbook is offered free. It helps you maintain your customers' fluorescent equipment at peak efficiency with minimum cost and inconvenience. It tells you how to spot trouble before it happens, how to estimate replacements, and many other operating hints. Testing and maintenance procedure is simplified. Clearly written, well illustrated with charts and diagrams. Easy to understand.

NEW SYLVANIA CATALOG—Here is a comprehensive catalog of Sylvania's complete packages of light. Industrial and commercial fluorescent fixtures, lamps and starters in the Sylvania line are described and pictured. It is handy for ready reference. It makes a valuable sales and estimating tool.

Both of these helps are offered to you without obligation on your part. Just fill in the coupon below.

SYLVANIA ELECTRIC PRODUCTS INC.
60 Boston Street, Salem, Mass. (Dept. EC 10)

Please send me the new Fluorescent Service and Maintenance Handbook and the new Sylvania catalog.

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Company _____

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One Standard — The Highest Anywhere Known



FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

Electrical Contracting, October 1944



ARMATURE LEADS of No. 40 H. F. coils are being dipped into first solution for five seconds. Leads are next dipped into second solution nearby prior to actual stripping.

29 H.F. wire at the required operating conditions. The time also varies with the temperature and freshness of the bath.

The wire is then dipped immediately into the second solution which is heated to a working temperature range of 120 to 140 degrees F. in a temperature-controlled water bath. The lead is submerged to a slightly greater depth and for the same length of time.

Then immediately upon removal from the second solution, several gentle strokes of the wire between thumb and forefinger removes the softened resin. The stripped lead can then be tinned at solder temperatures below 600 F.

SAFE ACCURATE PROCESS TIMING BY NEW ROTARY-TYPE TIMER

INDUSTRIAL

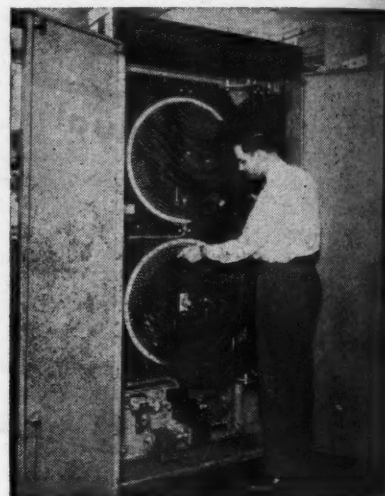
Automatic process timing is becoming more and more popular because of its greater safety and accuracy. Wherever measurement of time or material is critical to the production process some type of automatic equipment is generally required to secure satisfactory operation. Catalytic processes such as the production of hi-octane gasoline, butadiene for synthetic rubber and toluene for explosives are examples of processes requiring automatic timing to regulate the flow of products. The accompanying photographs show one of G.E.'s new two-dial rotary-type process timers developed for catalytic processes.

During the manufacture of these products, hundreds of accurately timed, sequential operations must be performed. Some of these operations involve the opening and closing of electrically operated valves, dampers, and other devices in a definitely timed cycle. Depending on the process requirements, a complete cycle of operations may require from twenty minutes to three hours, or more; from 18 to 75 devices may be controlled; and from 100 to 900 contact points or timing intervals may be needed.

These requirements are met by the new process timer in which each of the two dials has two concentric rings of 224 contact points each—a total of 896. Each dial has a rotating contact arm. The arms are geared to a single shaft



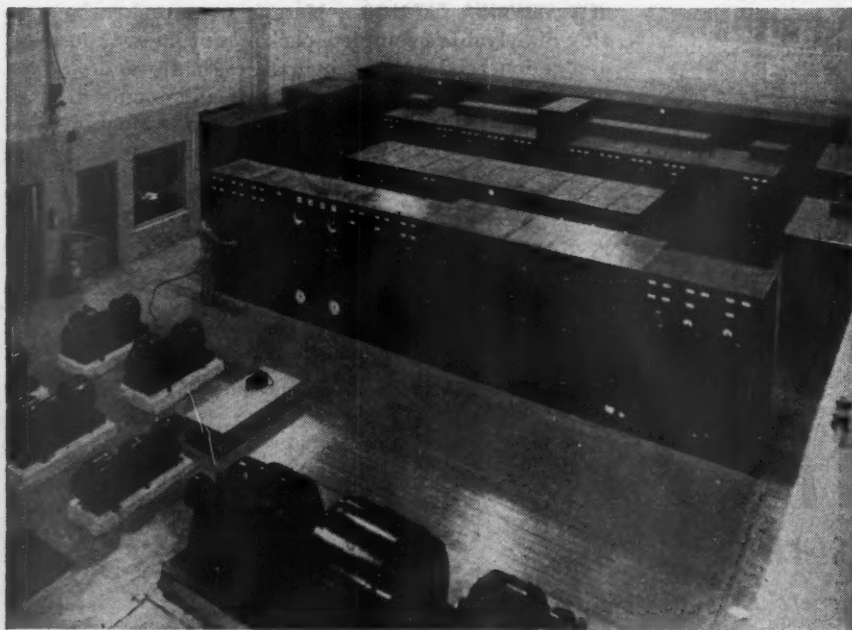
PROCESS TIMER (front view) showing the two-dial rotary-type construction. The operating arms are driven from a single shaft geared to a synchronous motor.



REAR VIEW shows the system of jumpers for changing taps to suit requirements. As synchronous motor drives rotating arm at a pre-selected speed over the contacts, the make-and-break of successive circuits permits accurate cyclic timing of any process.

and can be driven through a clutch by a synchronous motor and an adjustable gear train. The circuit to the segments is made and broken through an auxiliary switch, not at the segments themselves, and the unit will easily handle control circuits up to 10 amperes, 125 volts.

Essentially a large motor-driven selector switch, this timer operates at a speed which may be selected to suit the process. It is arranged to complete the circuits to the controlled devices as a moving brush selects each point. Flexible jumpers are provided for connecting between the segments and a terminal board. The jumpers are plugged to the segments which will provide the desired operating cycle and all incoming leads from the controlled devices are brought to the terminal board.



METAL-CLAD SWITCHGEAR and air-cooled transformers handle the electrical distribution needs at the Naval Operating Base in Long Beach, California. The Westinghouse metal-clad switchgear affords a maximum saving of space; and because it is completely sectionalized, safer operation is obtained.

**For simpler,
stronger
construction...**

**For greater
flexibility
of design...**



This ceiling hangs from the lighting fixtures

Adaptable to schools, offices, stores and industry...

One hundred years "in lighting" has taught us many things.

Among them the fact that providing better lighting is not enough. The fixture must be designed to *solve* construction problems for architects and builders—rather than to present *new* ones.

So . . . in designing the Miller 2-light Troffer to be the world's finest continuous fluorescent lighting system for offices, stores, schools and industry, we also designed it to be the most practicable to build with—and around.

Therefore . . . the patented Miller Bracket, which makes it possible to hang the troffer from the structural ceiling and then to suspend the false ceiling (either wood or metal frame) *from the troffer*. This effects construction

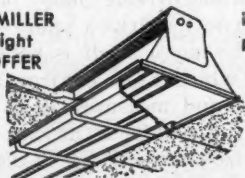
economies, makes for stronger construction and adds flexibility to the entire installation.

In fact, so versatile is the Miller Troffer—in single units, unit combinations or in continuous light-strips "by the mile"—that its applications are almost as unlimited as the architect's ingenuity.

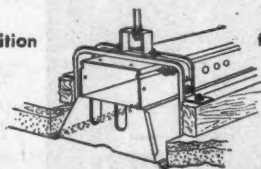
It is simple to service and so economical to operate that it encourages large installations—an important factor when the wartime bulge in industrial lighting tapers off and new users of fluorescent lighting are needed to fill the gap.

Miller Engineers are in principal cities and, as we work with all light sources, including mercury vapor and incandescent, they are unbiased. So call a Miller Engineer—or call us—and see why. The Miller Company starts its *second* hundred years, still in the lead!

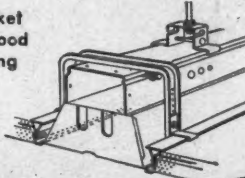
THE MILLER
2-light
TROFFER



in
position



Bracket
for wood
ceiling



Bracket for
metal ceiling

THE MILLER COMPANY • MERIDEN, CONNECTICUT

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Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Material

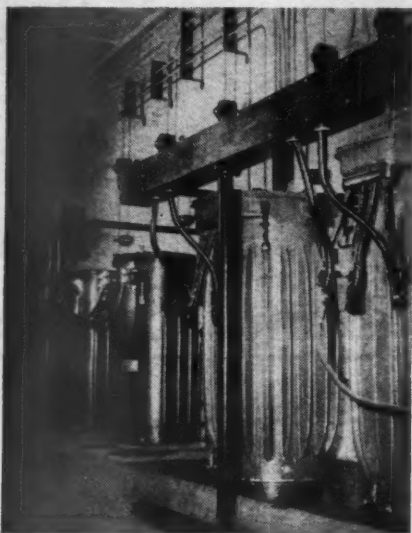


SECONDARY GUTTERS FOR LOAD CENTER SUBSTATIONS

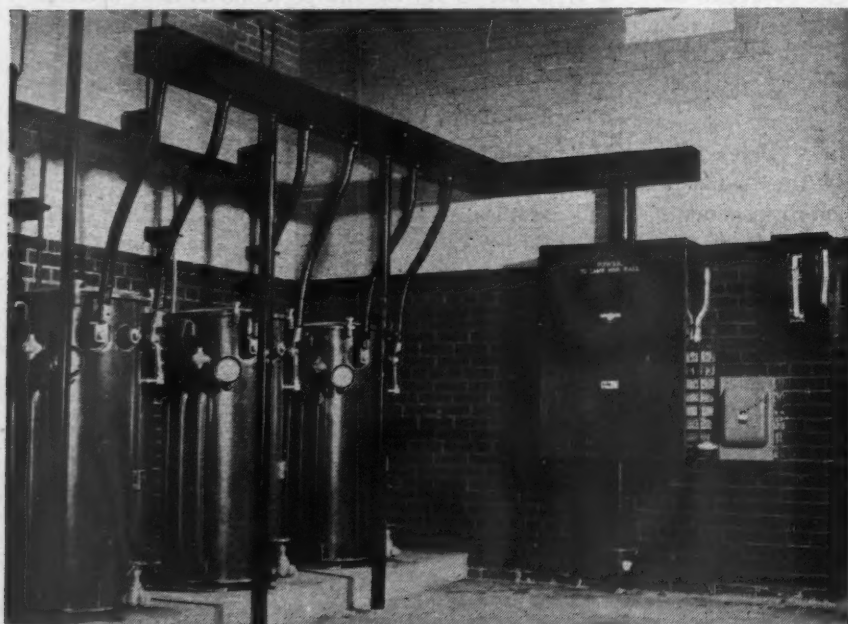
WIRING

Secondary leads from the transformers to the distribution panels are carried in sheet metal troughing in a number of the load center substations at Middletown Air Depot in Middletown, Pa. The Howard P. Foley Company of Harrisburg, Pennsylvania did the high voltage distribution and substation electrical work, the story of which was published in *Electrical Contracting*, August 1944 issue.

The secondary gutters were custom built and dimensions specified to accommodate the particular number and size of conductors involved. Welded



SHEET METAL TROUGH is used to carry secondary leads from transformers to panel in vault No. 4 for both power and lighting circuits.



PIPE SUPPORTS CARRY secondary gutters at convenient height in vault No. 13. Note transformer leads enter singly with three-phase connection made inside trough.

construction of thin gauge sheet metal was used exclusively with covers drilled and tapped on 12 inch centers for stove-bolt fastening. Covers were for the most part located on the side facing away from the transformer banks to facilitate construction and maintenance by providing greater accessibility.

The gutters were supported at a convenient height on lengths of one and a half inch pipe, fitted with floor flanges on each end for fastening to floor and gutter.

Cables were carried into the gutter singly through short nipples equipped with bushings on inside and outside. At the panel where all cables emerge together, large size conduit is used to connect panel and trough.

ROCKER-BASE MOTOR MOUNTING FOR BELT TIGHTENING

INDUSTRIAL

An adjustable motor mounting, which will permit the machine operator to always maintain proper belt tension, has been devised by C. W. McKee, electrical contractor, General Electric Service Company, in Harrisburg, Pennsylvania. Mr. McKee does all of the electrical construction and maintenance work for W. L. Brubaker Sons Company, Millersburg, Pa., where all belt drive machines with no other means of belt tightening are being equipped with adjustable motor mountings.

Very often the work being done on a machine will require such an increased amount of torque from the mo-



MOTOR MOUNTED on a rocker base permits it to be raised or lowered to tighten or loosen belt as required. Pillow-blocks on platform and axle welded to motor base plate provide pivot for assembly.

tor that existing belt tension is not sufficient to pull the load without an excess of slippage. Where an adjustable motor base has been installed it is a simple matter for the machine operator to make the proper adjustment. The mountings became necessary under the stress of war production with its continual changes in material specifications and increased speeds in machining which resulted in widely fluctuating loads demanding greater belt considerations.

The accompanying photograph shows a typical installation using a 3 horsepower motor rated 1800 rpm. driving a milling machine. The motor and mounting assembly are bolted to an angle iron frame which is in turn bolted to the machine tool. This angle frame consists simply of two vertical lengths of $2\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{3}{8}$ -inch angle bolted to the machine with two horizontal lengths of 2- by 2- by $\frac{1}{4}$ -inch angle welded to the vertical pieces.

The main motor platform which is cut from $\frac{3}{8}$ -inch steel plate measures 22 by 16 inches and is bolted to the horizontal angles. A rectangular hole in the platform allows the belt to drop from the driving pulley on the motor shaft to the driven pulley below.

The motor itself is bolted to a sub-base which is also cut from $\frac{3}{8}$ -inch steel-plate and measures 10 by 12 inches. To the underside at one end of this sub-base is welded a 12-inch length of one inch round steel stock for an axle so that an inch overhang is obtained on each side. One inch pillow blocks are then mounted on the platform on either side so that the motor will pivot around on this one inch axle.

The platform beneath the opposite end of the sub-base is tapped on four

THE NEW Beacon



...FOR BETTER LIGHTING IN OFFICE OR DRAFTING ROOM



The new Wakefield BEACON is built to standards you'd expect from Wakefield; offers top efficiency, along with lower cost.

A Certified Fleur-O-Lier, the BEACON is designed to combine high quality fluorescent lighting with simple, modern appearance. It's a "honey" for essential office or drafting room. Postwar, it can be a decided help for stores and other commercial interiors.

Maintenance is especially easy. There are no horizontal surfaces on which dust can collect. New rigid louvers are hinged to



make lamp replacement easy. Has twist-type sockets mounted with slot up, so lamps cannot fall out.

Etched, ribbed glass on the side panels gives smooth, diffused light. All-steel construction, finished in lustrous satin zinc, with white enamel reflecting surfaces. Pierced metal end caps are backed up with translucent plastic. And you can supply this 4-lamp fluorescent unit in stem suspension as pictured, or with close-up mounting for low-ceiling areas.

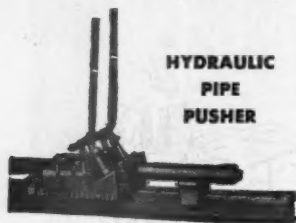
Help your customers handle paperwork faster, reduce eye-strain . . . with the BEACON. Get the details now from your Graybar house or write us.

Wakefield

THE F. W. WAKEFIELD BRASS COMPANY • VERMILION, OHIO



**"Half-a-day with
hit or miss...
5 minutes with
GREENLEE!"**



**HYDRAULIC
PIPE
PUSHER**

Use GREENLEE Pipe Pushers to install pipe for gas, electricity, water, sewers and telephone cable under ground. Eliminate cost of extensive trenching. And there's no tearing up of pavements and lawns, no backfilling, no repaving. A portable tool, easy to carry and set up, GREENLEE Pushers develop up to 75 tons of pressure, have 6 speeds for varying soil conditions.

If you ever tried to bend pipe by slamming it into a hole in the wall and then pounding it with a sledge hammer—listen to what Mr. Harry Newmark of Morris Newmark & Bros., electrical contractors, Philadelphia, has to say:

"This three-inch heavy wall electric conduit required exactly a one-inch offset. The job was done in 5 minutes flat . . . and could be duplicated on other conduits! With GREENLEES on the job, the savings in labor, time and money are incalculable."

One-man operated . . . easily carried to the job and set up, GREENLEE Benders eliminate manufactured bends and fittings, make smooth, accurate bends on pipe up to 4½", rigid and thin wall conduit, tubing or bus bars. *Whatever* your bending job, use a GREENLEE to do it better, faster!

Write for free copy of Catalog 33E. Contains complete facts on all GREENLEE tools for electrical workers. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1750 Columbia Avenue, Rockford, Illinois.



Other GREENLEE time-saving tools for electrical work:

CABLE PULLERS

JOIST BORERS

HAND BENDERS

RADIO CHASSIS PUNCHES

KNOCKOUT TOOLS



Get Ready with Greenlee!

REGISTERED TOOLS

GREENLEE

FOR THE CRAFTSMAN

inch centers to accommodate two cap-screws which either raises or lowers the motor base as required for proper belt tension. Each cap-screw is provided with a locking nut so that an adjustment once made can be maintained indefinitely.

GROUNDING PLANT EQUIPMENT UNDER WOOD CONSTRUCTION

WINING

The wood construction of war plants has considerably increased the problems of grounding plant machinery which embodies electrical equipment. The situation has been further complicated by the scarcity of material and many plants have felt the squeeze to a much greater extent than others.

At the American Aviation Corporation in Jamestown, New York, where the entire main plant is constructed of wood, all circuits carried a grounded conductor. And the grounded conduc-

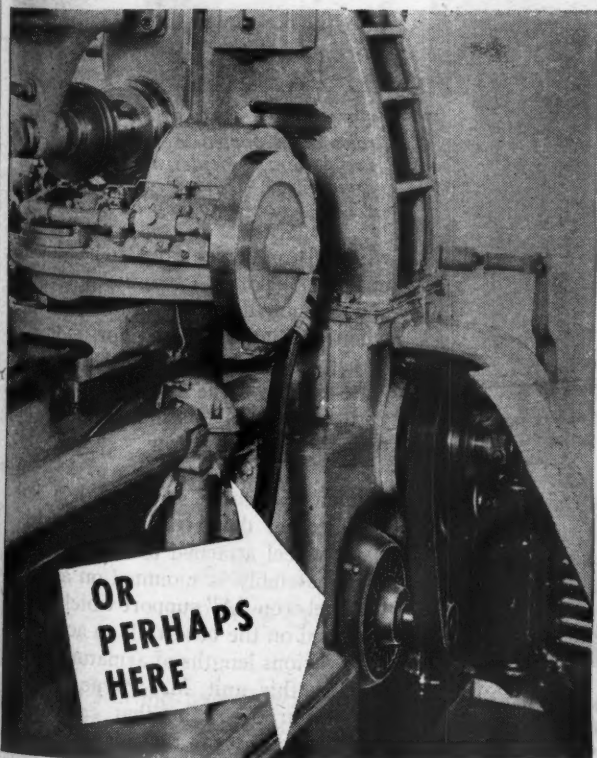
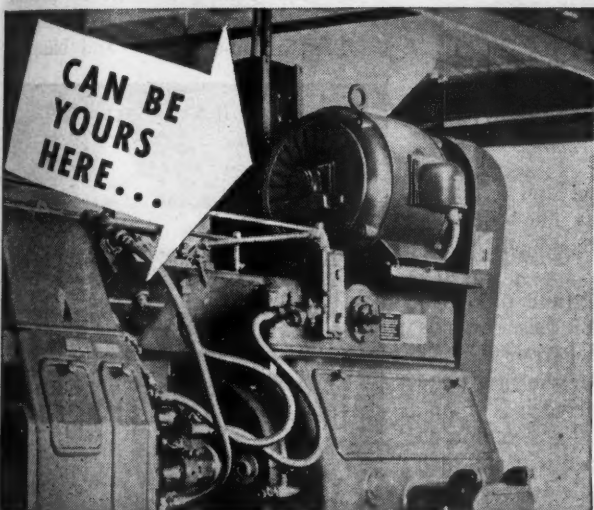
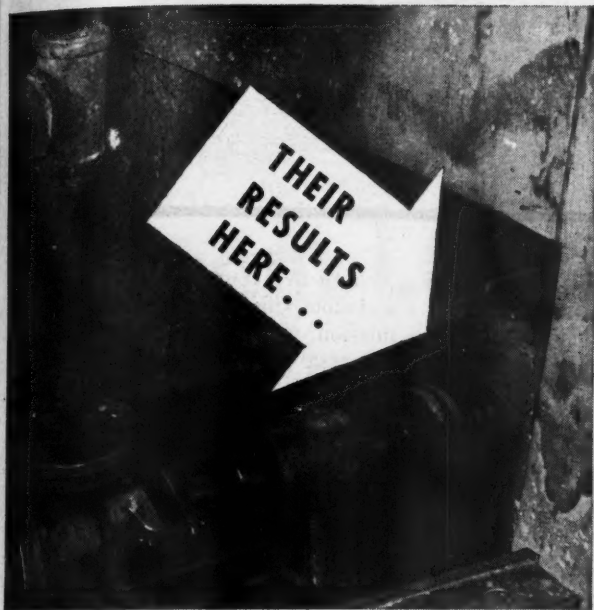


GROUNDING WIRE taped to motor cord of jib crane. Bolt through cover provides terminal for the ground wires.

tors were connected to driven grounds at specified points throughout the plant. However, grounded receptacles could not be obtained for installation where they would have been very convenient.

The accompanying illustration shows how all the electric jib cranes were grounded. The cover of the receptacle for the motor leads was tapped for a through bolt providing a terminal on the inside for the circuit ground and one on the outside for the ground wire to the jib crane. Flexible rubber-covered cord was required from receptacle to motor because of the large arc swing of the boom and the back-and-forth travel of the crane. The insulated grounding wire was taped at intervals to the flexible cord to avoid tangling.

[Continued on page 194]



Uni-Shell MOTOR HANDLES A TOUGH JOB FOR 6 YEARS!

For six years, an R & M Uni-Shell Motor and R & M Moyno Pump used by Macatee, Inc., Dallas, have been on the job producing ready-mixed mortar without a single breakdown.

First, lump lime is slaked. And, while at a temperature of 215° F., this milk of lime is drawn through the pump from 60 feet away and lifted 30 feet into storage tanks.

After about three weeks the stored lime from which the water has been drawn is in a heavy plastic or putty state. The same motor and pump then draw the lime putty from the storage tanks and lift it to a loading hopper 20 feet above the pump. One Uni-Shell Motor running forward and reverse handles *both* operations.

And such performance isn't limited in application. You can have it on lathes, milling machines; in fact, on motor-driven equipment of any kind.

When considering motor power for all types of equipment, it is well to remember that the Uni-Shell line is the only complete motor line in which all types in any one frame size are *interchangeable* and similar in appearance.

For example, with equipment ordinarily built for poly-phase induction motors, the occasional need for single-phase or direct-current motors requires only a simple replacement.

Get all the facts on the ways in which Uni-Shell long life and easy interchangeability can help solve your motor problems. Ask for the helpful, 20-page Uni-Shell Motor booklet, today.



SHIPMENT NOW!

Ample stock on most types of integral motors on hand as this goes to press. Wire or phone your inquiry.

ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

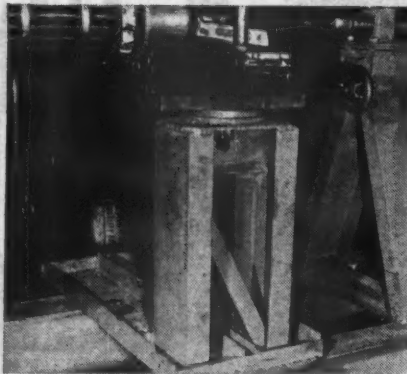
MOTOR SHOPS

BEDLESS LATHE FOR BIG ARMATURES

Motor shop operators have yet to be stymied when it comes to designing equipment that will add to the efficiency of their shop operation. If such equipment is not available or manufactured, they set about making it themselves.

Wm. M. Payne, Payne Electric Co., Houston, Texas, solved a puzzler by doing just that. Among his biggest customers are the shipyards in the area who send him considerable electric welding machine work—armatures to be repaired and rewound. Such armatures are equipped with large fans which defy attempts to remove them. Conventional lathes in the Payne shop could not accommodate any large diameter armatures or fan attachments, so he looked around for a unit that would do the job. Unable to locate any, he built one of his own design.

From a theoretical standpoint this lathe has no bed. It consists of a face-plate-drive mounted on a stationary support, a tool post and tail stock supports which slide on the base rails for quick adjustment. This unit can accommodate armatures with a maxi-



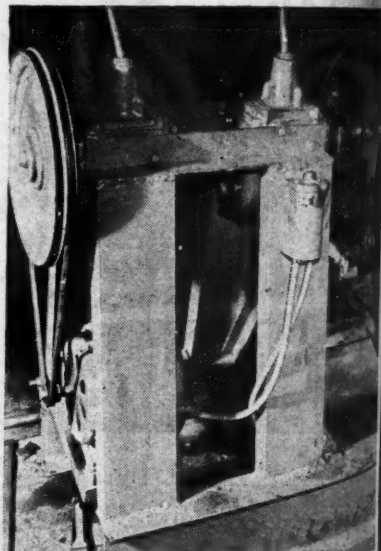
TOOL POST SUPPORT with conventional lathe feed is adjustable and can be used with cutting tool, undercutter, banding wire tension device, or magnet wire tension and guide attachment for coil winding.

mum diameter of 5-feet and a maximum shaft length of 5-ft. The base rails can be extended to accommodate longer shafts, if necessary.

The base rails are sections of 8-inch I-beam. At one end of these rails is welded a 6-inch channel from the "A" supporting structure for the face plate drive. Heart of the drive is a 1 hp., 1150 rpm., 3-phase, 220-volt motor on a floating base. Equipped with a 2-inch sheave, this motor belt-drives a 15-

inch sheave connected to the shaft of a double Chevrolet automobile transmission which, connected through a universal joint, provides a speed range from 6 to 100 rpm. By using the reverse position of the transmission and the reversing switch on the motor an extra speed ahead is obtained.

The tool post is mounted on a 6-inch, channel iron, L-shaped support which can be adjusted front or back and left or right to fit the job at hand. Mounted to the tool post is a conventional lathe cross feed equipped with a cutting tool. For undercutting or armature banding, an undercutter and banding

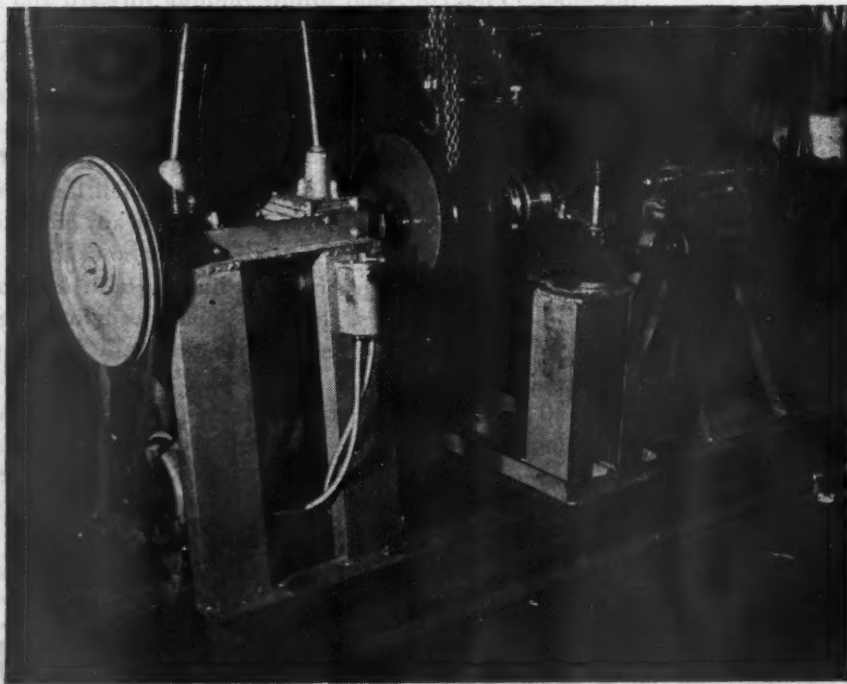


TWIN TRANSMISSIONS from Chevrolet cars, coupled together with a universal joint, provides a 6 to 100 rpm. speed range. Driving motor is mounted on a floating base.

wire tension device can also be attached to the tool post. A magnet wire guide and tension device can also be added when the lathe is used for motor or transformer coil winding. The face plate of the lathe is adapted for use with an "Ideal" winding head and transformer coil forms.

The tail stock consists of a 2-inch diameter machine screw with a lathe dead center driven in one end with a hand wheel attached to the other end. This assembly is mounted on a 6-inch channel iron "A" support which can be adjusted on the base rails to accommodate various lengths of armature shafts.

With this unit, Mr. Payne now has an all-purpose lathe that can handle practically any job that may come into



BEDLESS LATHE, designed by Houston's Payne Electric Co., to accommodate large diameter armatures, can be used for turning down, undercutting and banding armatures and for winding motor and transformer coils.



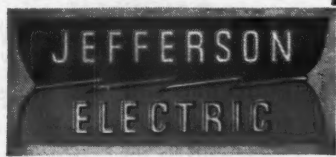
Bottom Leads *or* End Leads

This One Ballast provides for both...

● For direct mounting on narrow wiring channels or fixtures, bring the leads out of the bottom.

For other applications, extend them from the ends. Insulated bushings set at an angle protect the leads either way.

Simplify your fluorescent lamp Ballast inventory,—reduce stock investment and save time. Order the new Ballasts now. Available in two-lamp 40-watt sizes with other popular capacities shortly. **JEFFERSON ELECTRIC COMPANY**, Bellwood (Suburb of Chicago), Illinois. In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ontario.

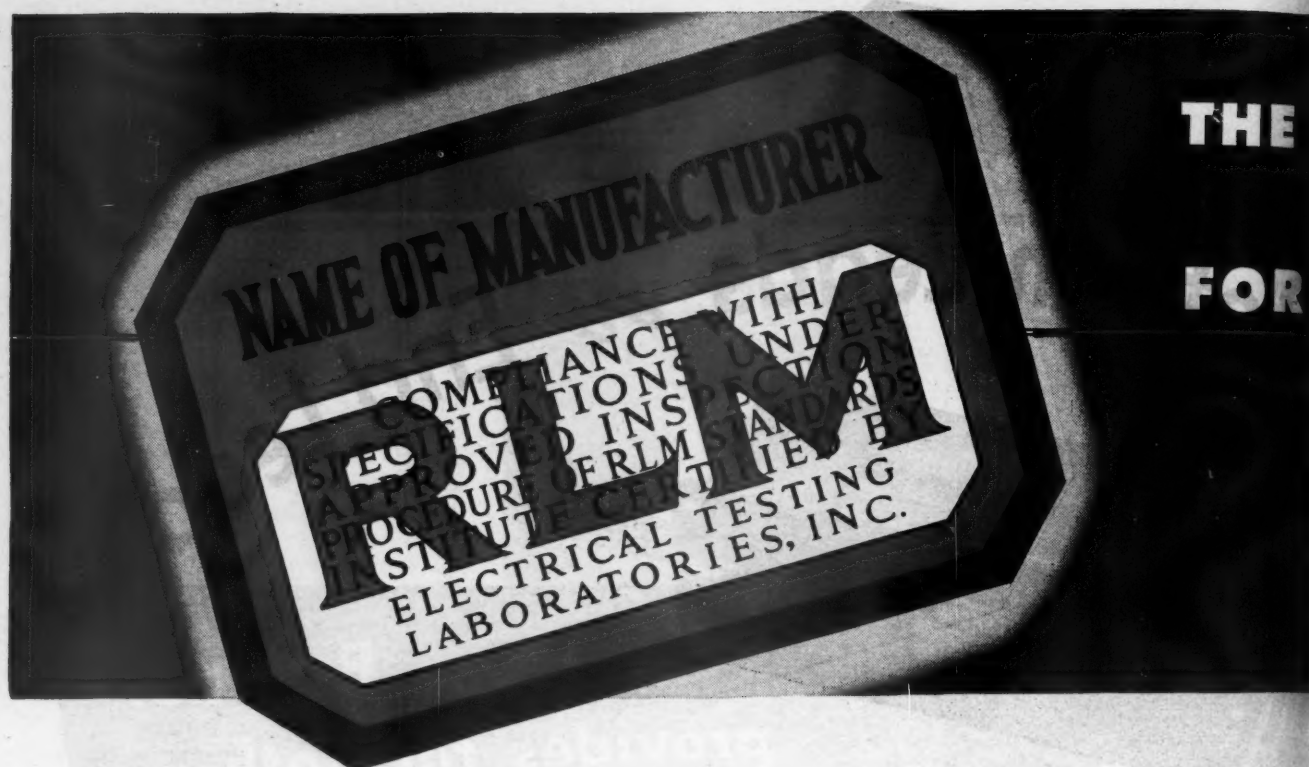


A MAJOR DEVELOPMENT OF VITAL IMPORTANCE

- ✓ No Duplication of Stock
- ✓ Lower Ballast Investment
- ✓ Fit Various Installation Requirements
- ✓ Conserve Manpower

BALLASTS FOR FLUORESCENT LAMPS

Instant Starting Ballasts now available in the two-lamp 40-watt sizes. These Ballasts make possible starting without separate starter action or cathode pre-heating, and will be furnished with leads for both bottom and end positions.



THE

FOR

Yesterday —

To improve industrial lighting practice was the guiding motive behind the founding of the RLM Standards Institute.

It was founded as an organization not for profit, to encourage wider acceptance of *scientifically engineered* industrial fixtures, and to secure the widest possible acceptance of performance specifications for such fixtures. The aim was to make use of every available foot-candle of light, so that every fixture bearing RLM approval would be instantly recognized by the buyer as a guaranteed lighting product of high quality.

In this the RLM manufacturer members have succeeded . . . buyers of industrial lighting fixtures instinctively select those bearing the RLM label, knowing that they are getting for their plants the best in efficiency, economy, and long life.

Objectives of the Institute

To make, or cause to be made, and to supervise tests, investigations, experiments and inspections in connection with the manufacture and marketing of lighting equipment, lighting fixtures and pertinent accessories thereto.

- To formulate, administer and disseminate specifications of standards in design, construction, composition, finish, performance and service of lighting equipment, and to secure compliance with such specifications on the part of the members of the RLM Standards Institute, and others.

- To issue publications, bulletins, certificates, labels, and other printed matter in order to properly inform the public and all others using, specifying, installing or distributing lighting equipment about such tests, investigations, experiments and inspections.

- To promote, encourage in the public mind by publicity a keener interest in the advantages of the modern lighting equipment.

- To promote friendly and intelligent co-operation among its members and with other associations, organizations and institutions interested in the same or similar objectives.

In fulfilling these objectives, RLM Standards Institute has simplified the selection of fixtures properly designed and built for providing efficient and effective industrial lighting . . . as buyers have come to recognize that fixtures bearing the RLM LABEL comply in every respect with sound specifications of standards in design, construction, composition, finish, performance and service.

SYMBOL OF COLLABORATION

Quality AND Progress

Pioneers in industrial lighting for 21 years, members of RLM Standards Institute have worked together to give deep significance to the RLM label. It has come to symbolize certain carefully engineered industrial fixtures that give

★ Engineered Lighting

- ★ Economy through More Light at No Extra Cost
- ★ Low Maintenance Costs and Long Life
- ★ Instant recognition by buyers of these guaranteed qualities, in industrial fixtures bearing the RLM label.

Thus RLM fixtures are more readily bought, more easily sold.

Tomorrow—

There is a universally recognized forward trend in modern lighting, fostered by the Institute and individually by its members. Continued progress will be made in providing better lighting for better seeing—made possible by an unusual type of engineering co-operation under the guidance of strong and enlightened leadership.

50 Foot-candles in 1950

While 50 foot-candles has become standard lighting practice in some of the more progressive war plants, there are still innumerable plants, offices, schools and other establishments where the average lighting ranges from 10 to 18 foot-candles.

This, then, is a tremendous field which RLM Standards Institute will continue to cultivate... so that by 1950 the minimum accepted standard for general lighting, and for every seeing task will be 50 foot-candles.

To Sell More Than Fixtures— Sell Illumination

The lighting fixture is primarily a means to *illumination*. The illumination problem must be clearly understood, if the *right* fixtures to solve it are to be purchased. RLM Standards Institute has long recognized this fact and new specifications to meet the great changes of tomorrow's world will follow this pattern.

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

RLM Standards Institute and its members, in the future, will continue to educate the architect, engineer, contractor, property owner and manager, etc. to recognize this fact: *that the point of attack on any illumination problem is to avail themselves of the lighting experience and lighting data of the RLM Institute, its members and their distributors.*

New Testing and Inspection Specifications

In co-operation with Electrical Testing Laboratories, Inc., a Committee of the Institute is developing a set of testing and inspection specifications to be used in connection with the various lighting specifications which will not only form the basis of the inspection and testing methods used by Electrical Testing Laboratories Inc. but may also be used by any governmental or other testing agency to check results whenever desired.

Other research and educational work is in progress now, by the Institute and by its members, looking toward the post-war world when the many technological advancements of war will be utilized to make man healthier and happier in his home and at his work. And foremost among the factors contributing to increased health and happiness is—"Better Light for Better Sight."

RLM STANDARDS INSTITUTE

INCORPORATED

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**TO SAVE TIME, MANPOWER, SPACE,
TODAY and TOMORROW...**

**the filing cabinet idea
... applied to
motor control**



1. Skeleton Starter

This Unitrol "unit" is fitted into a section (see photo No. 3) and sections are placed side by side, as many as you want as in sketch at bottom.

Like your filing cabinet system, the contents of each "drawer" are easily changed or placed in other "drawers".



2. Unitrol Door Frame

Sections can be rearranged, moved elsewhere, or new ones added. Unitrol is the flexible, versatile system of housing motor control for all time, ready at any time to meet all needs. You should investigate it today.



3. Unitrol Section



4. Unitrol Control Center

use UNITROL

You can begin any time to put in UNITROL, the better way to house, install and systematize motor control. If you are buying control for new machines, ask for it in Unitrol. Then you won't have to spend time and manpower on wall or floor preparation. Unitrol can be placed anywhere in the plant ready for work the moment electrical connections are made.

If you are moving equipment around because of a production changeover, make it an opportunity to house the control in Unitrol. Then your inspection and service men can accomplish more because the control will be grouped in a compact Unitrol "center", convenient of access, easy to service, hard to overlook. Tremendous space savings result because Unitrol can accommodate 2 or 3 times as much control in equivalent floor space.

Unitrol is the modern method of housing control, ready made, ready for use, yet built to individual need from unitized, sectionalized members that you can add to, subtract from or rearrange with complete freedom. Many industrials, wanting to be first with the right answer for today and tomorrow, are swinging to Unitrol. For the facts behind the swing, write today for the big free Unitrol book. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.



the shop. The headaches and "make-shifting" this unit has saved the Payne crew has more than paid for it many times over.

COMPLETELY AUTOMATIC COIL WINDER

Walter J. Rider, owner of one of Binghamton, New York's leading motor shops, spends most of his time designing shop equipment and gadgets that will help his employees do their work better and faster. His shop is full of short-cut tools.

His newest development is an automatic magnet-coil winder that requires the operator only to step on a foot switch (after the initial set up) and any number of identical coils can be perfectly wound as fast as the operator can remove them from the form.

The machine is shown in the accompanying photograph. The main drive, clutches, and gear train are mounted within the composition-board enclosed frame. The driving motor is an ordinary sewing machine motor direct-connected to an old Metz car-type friction clutch (shown diagrammatically). The driven member of this clutch then transmits its power through a belt speed-reduction stage to the winding head.

The Metz clutch in this particular case is designed to give a five to one speed ratio. The driven wheel is three inches in diameter while the driving disc is 15 inches in diameter. The



AUTOMATIC COIL WINDER with cross-travel coil-throw guide and adjustable speed winding head. Revolution counter stops winding head after preset number of turns have been made. Note brake wheel on reel shaft for holding correct wire tension.

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"INSTANT-START" MODELS... CHOICE OF REFLECTORS IN
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with "MEGGER" INSULATION TESTING INSTRUMENTS

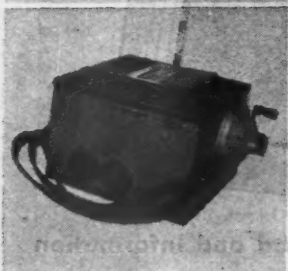
Today's heavy demand on every type of electrical equipment makes maintenance a matter of vital importance. Regular check tests of the insulation on motors, cables, controls and other electrical apparatus will save priceless time through the detection of incipient failures and the application of corrective measures.

Make sure that you have a "Megger" instrument and that it is used regularly and frequently. Minutes with the "Megger" tester can save days of delay. If you are not aware of the protection afforded by the use of "Megger" instruments and their importance in keeping electrical equipment in operation, write for the Pocket Manual of "Megger" Practice, No. 1420-EC.



THE NEW U. S.-MADE "MEGGER"

INSULATION TESTER—Consists essentially of a direct-reading true ohmmeter of the permanent magnet moving coil type mounted with a d-c hand generator in a plastic molded case. Ranges up to 1000 megohms, with hand generators up to 500 volts. Widely used in hard service. Variable-pressure ("Meg") and constant-pressure ("Super-Meg") types. Bulletin 1735-EC.



THE "BRIDGE-MEG" RESISTANCE TESTER

—This instrument is a combined "Megger" Insulation Tester and a four-dial, multi-ratio Wheatstone Bridge. Will measure any ohmic resistance from .01 ohm up to 100 or 200 megohms; hand generators rated up to 1000 volts. A complete and compact resistance measuring unit that is ideal for power companies and industrial plants. Catalog 1685-EC.



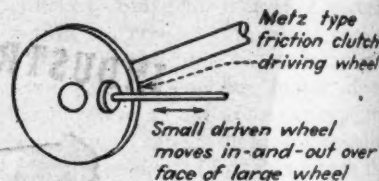
THE MIDGET "MEGGER" TESTER—In many ways the most remarkable "Megger" instrument ever built. Weighs only 3 lbs.—will fit an overcoat pocket or tool kit. Reads up to 50 megohms. Generates 500 volts and is always ready to use anywhere because of the hand crank. Send for Catalog 1690-EC.

**JAMES G. BIDDLE CO. • 1211-13 ARCH STREET
PHILADELPHIA 7, PA.**

circumference of the small wheel rides on the face of the larger driving wheel; thus as the small wheel is adjusted toward the outer edge of the larger one, its speed continually increases reaching a maximum at the extreme edge. A mechanical adjustment permits the operator to position the small wheel on the driving face and thus obtain any fixed speed on the winding head between 80 and 400 rpm.

In order to build the coil up evenly over the entire coil-throw, an automatic cross-travel guide has been provided. Through another friction clutch and a special gear box any required cross-travel speed can be obtained to meet the requirements of the size wire being used and the speed of the winding head. Cross-travel which reverses automatically, can be adjusted for coil-throws (or coil widths) from $\frac{1}{4}$ inch to six inches.

Correct wire tension is obtained by braking the coil of magnet wire. The spool, instead of idling on an auxiliary



DIAGRAMMATIC SKETCH of Metz type clutch. The circumference of the small wheel rides on the face of the larger one. Maximum speed is obtained at the edge; adjusting the small wheel to the left toward the center of the disc reduces the speed.

shaft, is securely tightened to a bearing shaft on which is also mounted a brake wheel. An adjustable brake band with brake lining permits any amount of tightening to obtain the correct degree of tension. The winder is equipped with two such reel-and-tension devices so that two wires can be wound onto a form simultaneously.

A Veeder-Root counter, equipped with contacts, permits any number of turns to be preset. When the correct number of revolutions have been made, the contacts operate a relay that in turn operate a magnetic breaker stopping the winding head.

After the initial set-up has been made, including winding head speed adjustment, cross-travel speed, coil throw and the number of turns, the operator kicks a pushbutton with his foot to start the motor. He then steps on the foot pedal which closes a contact and energizes a solenoid which engages the Metz type friction clutch. This action puts both the winding head and the cross-travel guide into operation. When the preset number of turns have been made, the counter relay operates the magnetic breaker which opens the solenoid circuit, stopping machine.

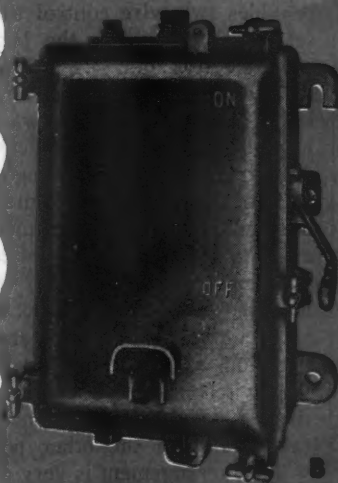
Federal

INDUSTRIAL CONTROLS

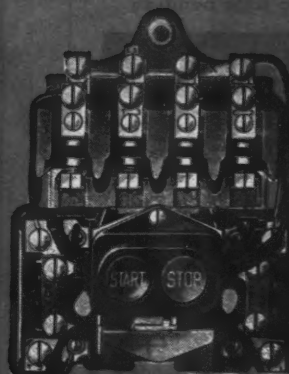
engineered to outlast the equipment they control



Don't be surprised if the Federal controls you buy for one machine outlasts two, three or even four others. For—Federal builds 'em for long life. Designs them to withstand the rigors of hard usage. To take in stride shocks ... vibrations — or what have you. Expect to find, too, ample wiring space ... easily removable contacts ... efficient operation ... ease and economy in maintenance. For safe and dependable control of motor-driven machinery depend on Federal.



- A. Reversing magnetic starter Type "A" sheet steel cabinet
- B. Combination motor starter Type "D" weatherproof cabinet
- C. Manual Motor starter Type "A" sheet steel cabinet
- D. Magnetic Motor starter Type "U"—inside only
- E. Push button station



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Smooth, remotely controlled hydraulic power bends rigid conduit and pipe up to 4" diameter. Saves need for elbows and couplings and otherwise necessary cutting and threading.

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BENCH TEST UNITS

Four identical test units connected in multiple are mounted on the wall above the long assembly bench in the motor repair shop of Marvin W. Gleason in Binghamton, N. Y. All connections, receptacles, switches, etc., are made within or mounted on the covers of the standard 10 by 10 by 4 inch pull-boxes. The arrangement can be seen in the accompanying photograph and circuit diagram.

A.C. and d.c. are brought to a double pole, double throw switch so that test leads may be energized with either at the option of the tester. The duplex receptacle is a.c. and hot at all times. A pilot light is connected across the incoming d.c. leads so that the tester knows whether or not the m-g set is operating. A rheostat adjustment is provided so that any d.c. voltage between 30 and 115 volts can be obtained from the d.c. generator.

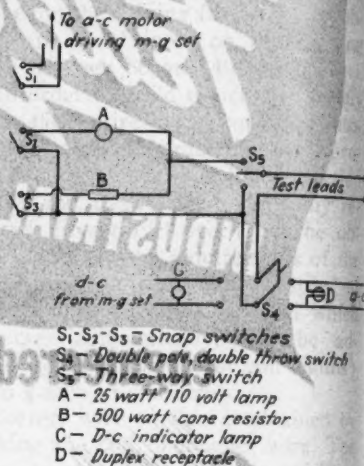
A bank of three snap-switches is mounted in the lower left hand corner of the box (see photo). The top button provides two wire control to the m-g set installed beneath the bench. The center button cuts the 25-watt lamp in and out of the test lead circuit. The lower button cuts the 500-watt resistor in and out of the test lead circuit (see diagram). Thus, by closing either or both of the two lower buttons three different values of resistance can be cut into series with the test leads.

The three-way switch, which is mounted between the duplex receptacle and the triple snap-switch station, will give full voltage at the test leads with the switch in one position, or will cut the set amount of resistance into the test circuit in the other position.

This arrangement is very convenient

since only one set of test leads are required.

On the side of the test panel is seen a small soldering transformer, switch and indicating light. The transformer was formerly a solenoid coil on the outside of which has been wound a few



CIRCUIT DIAGRAM of bench testing unit. Double throw switch S₄ supplies either a.c. or d.c. Three way switch S₃ cuts resistance in series or furnishes full voltage to test leads.

turns of No. 8 wire for a secondary voltage of 6 volts and a capacity of about 300 watts.

Secondary leads are brought through separate wood block handles. One lead terminates in a carbon block while the other terminates in a short piece of No. 6 solid copper. The two electrodes are used for fine soldering or unsoldering jobs. By touching the two together (as in the photo) the tip of the copper electrode, which is pointed, heats up very quickly. The gadget is simple to make and easy to use. Its best characteristic is that soldering heat can be obtained almost instantly.

[Continued on page 198]



SOLDERING TRANSFORMER mounted on side of test panel operates on 110 volts, 60 cycles and provides six volts at the electrodes. By touching the carbon electrode to the copper electrode soldering heat is obtained instantly. Can be used for fine soldering or to unsolder joints.

Why you can LOOK TO LIGHTING for immediate Postwar Profits

Three Big General Electric Programs Are Helping Build Your Postwar Lighting Business

Get ready for the biggest expansion in commercial lighting history! A million and a half stores need relighting and here are three practical sales advantages G-E now offers to help you realize all the benefits of this profitable new lighting business.

1. New Fixture Ideas are being developed to help you sell more jobs and better jobs. General Electric has commissioned some of the nation's leading architects and designers to create new store lighting interiors and suggest ideas for more flexible, more attractive fixtures. (See next page.) These are being turned over to fixture manufacturers for development.

2. New G-E Fluorescent Lamps are scheduled for production as soon as conditions permit . . . lamps that will produce better lighting than anything your customers have ever had . . . long, slim, fluorescent lamps, circular fluorescent lamps and fluorescent lamps for instant-starting.

3. G-E Advertising is pre-selling your customers and prospects now with full-page ads in national magazines and 42 publications in specific commercial fields—the broadest commercial advertising program in the history of lighting.



GENERAL ELECTRIC

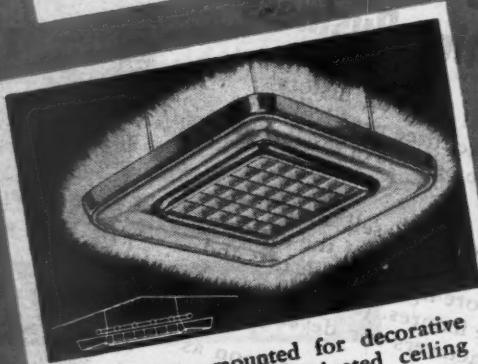
From G-E's Design Program-IDEAS OF



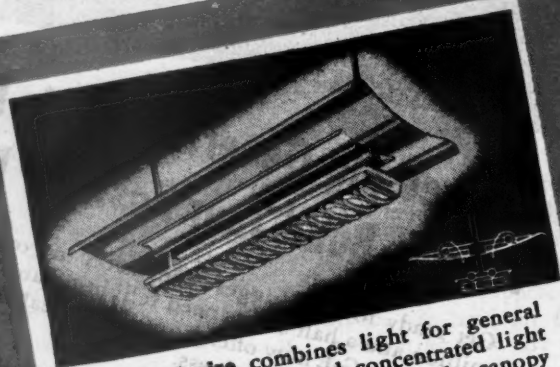
Drug stores want modern lighting like this just as soon as they can get it. Plan and fixture are by J. Gordon Lippincott, of Dohner & Lippincott, New York.



Combination fluorescent and filament lighting fixture shown above employs four 48-inch fluorescent lamps plus concentrated down-lighting on displayed merchandise.



This fixture, mounted for decorative effect on coffered laminated ceiling panels, features an interesting combination of deep drawn plastic shields and plastic louvered centers.



This luminaire combines light for general ceiling illumination and concentrated light that highlights display surfaces. The canopy is low-pressure molded plastic; lower part is translucent plastic.



Food Stores are in the market for lighting that accentuates the buying atmosphere and attracts customers. Plan and fixtures are by Morris Sanders, New York.

GENERAL ELECTRIC

Peer the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

LEADING DESIGNERS ON POSTWAR FIXTURES

TODAY, almost 1,500,000 stores in this country need relighting. To help you bring them the full benefits of modern lighting, General Electric is commissioning leading architects and designers to work out ideas for new and more attractive lighting fixtures. Seventeen of these men are now at work on this program. Several of their ideas are illustrated here. More of them will be ready soon.

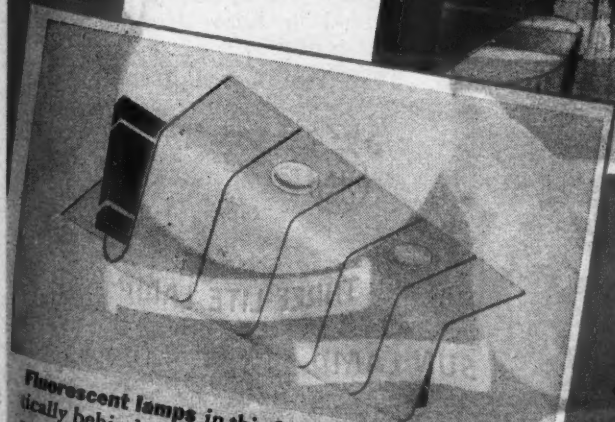
From these original designs, fixture manufacturers are already working on new lighting tools that will help you get a full share of postwar lighting profits.

ILLUSTRATED BOOKLET describing G-E's design program is now available. Write for Booklet Y-467, General Electric, Nela Park, Cleveland 12, Ohio.



Shallow, ceiling-mounted fixture with translucent plastic sides and "egg-crate" plastic housings for light diffusion. Two spotlight housings in center are adjustable for directional lighting.

Department and Specialty stores know that good lighting sells merchandise. Thousands already have complete modernization programs. Plan and fixtures shown here are by Graham, Anderson, Probst & White, Chicago.



Fluorescent lamps in this fixture are arranged vertically behind a plastic diffusing shield. Adjustable spot or reflector lamps may be readily directed on special merchandise displays.

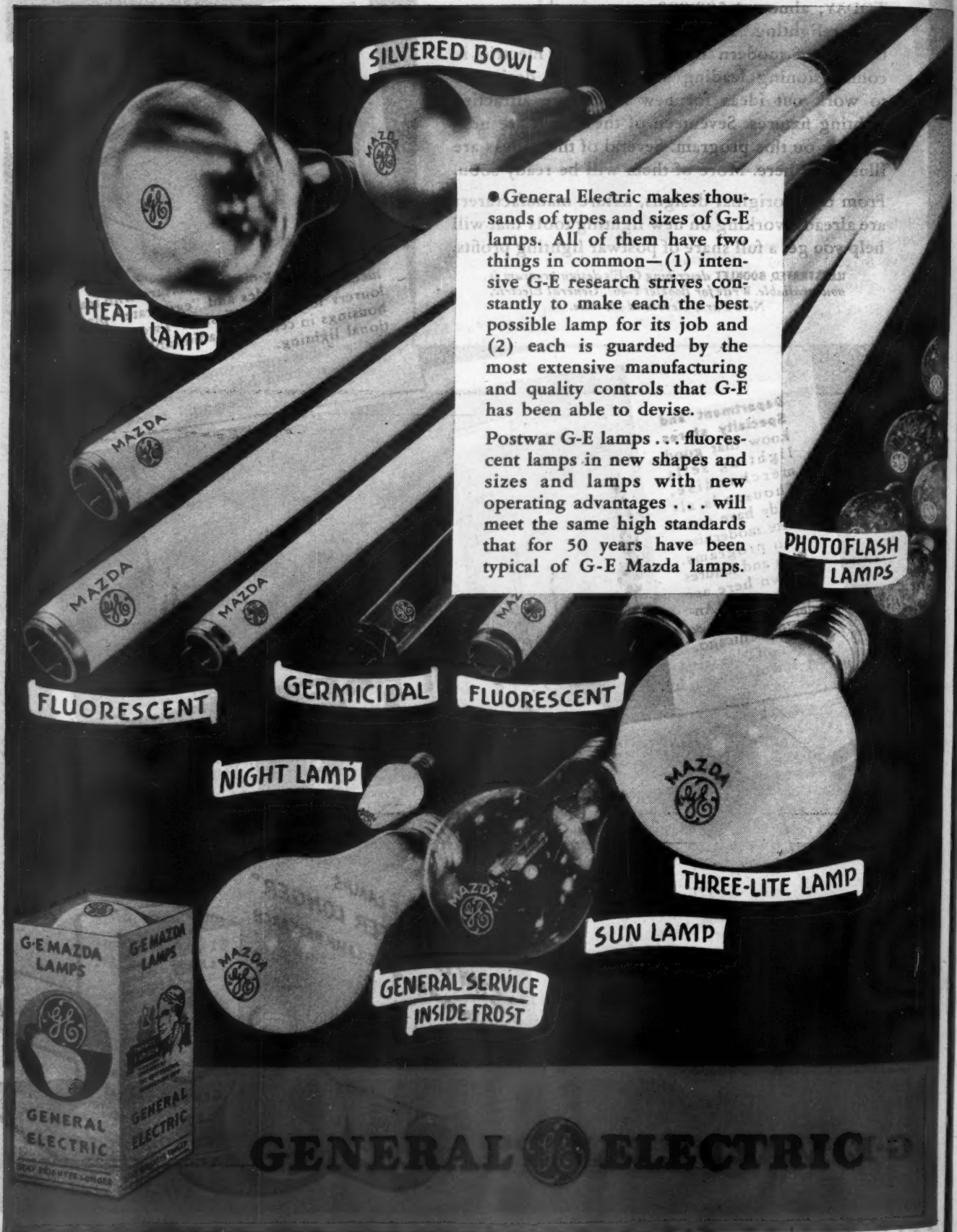
"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"
The Constant Aim of G-E LAMP RESEARCH



G-E MAZDA LAMPS

KEEP BUYING WAR BONDS — KEEP THE WAR BONDS YOU BUY

General Electric is developing new and better postwar G-E lamps



Answered by
F. N. M. SQUIRES and **GLENN ROWELL**

Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

THE 1945 CODE

Q. "Is there a revision in the new 1945 Code calling for the elimination of No. 14 BSG as a standard requiring that all lighting and power circuits be wired with No. 12 BSG as a minimum?"—J.D.K.

A. There has as yet been no 1945 Code issued. It is now proposed and the work is well under way to revise the 1940 Code with its supplement of Interim Amendments into a 1945 Code.

There has been a suggestion that No. 12 wire be the minimum size wire to be permitted for branch circuit wiring but there has been considerable opposition to this proposal inasmuch as the proposal also suggests that the minimum branch circuit fuse be 20 amperes. While there is not much opposition to the No. 12 wire although there is difficulty with some wiring devices in connecting a No. 12 wire, there is a great deal of opposition to protecting flexible cords of No. 18 and No. 16 and tinsel cord by means of the 20 ampere fuses, as it is known that fuses of such size will not afford proper protection to those small cords. The outcome will not be known for about a year or so.—F.N.M.S.

BRANCH CIRCUITS

Q. "The total connected lighting load in a hotel ballroom will amount to 18,000 watts. What is the minimum number of No. 14 wire branch circuits that we can install and comply with the Code rules?"—T.B.

A. The National Electrical Code will require a minimum of 14 circuits to supply 18,000 watts of lighting in this ballroom. The wattage of the individual lighting fixtures may make it necessary to use even more than 14 circuits. Section 2107 of the Code contains the following often violated provision: "If circuits supply continuous loads, such as store lighting and similar loads, the load shall not

exceed 80 percent of the branch circuit rating." Too many have missed "and similar loads" and think that this provision applies only to store lighting. Any branch circuit supplying continuous loads must not carry more than 80 percent of the circuit rating. And a continuous load is defined as a load extending over a period of three consecutive hours or six non-consecutive hours during any twenty-four hour period.—G.R.

CONDUCTOR FOR FLUORESCENT LIGHTING

Q. "We have a fluorescent lighting job to install with a type of fixture designed and approved for continuous trough lighting and wish to run the circuits within the raceways formed by the fixtures. What type of conductor may we install for these circuits?"—A.P.

A. The National Electrical Code has definite requirements pertaining to the ambient temperatures in which various types of conductors may be used and also the maximum permissible carrying capacity at various ambient temperatures. The fixture manufacturers can furnish the maximum operating temperatures of the particular fixture to be used and with that information the proper type and size of conductor may be determined. Section 3005 and Table No. 1 govern such an installation, and it is possible that you may have to use type AVA or AVB conductors.—G.R.

SEALING FITTINGS

Q. "We are rewiring a gasoline bulk station, and the local inspector has advised us that he cannot approve the installation because the sealing fittings used have formed moisture traps on two of the conduit runs extending through the office. What can we do to overcome this, or is the inspector wrong?"—W.M.

A. No, the inspector is undoubtedly correct. Under Section 5014-b you will find the following: "In locating seals, due consideration shall be given to the possibility of water being trapped. If there is such a possibility, due to condensation or other causes, the conduit system shall be so arranged that water will collect in an explosion-proof sump which may be drained periodically". Whenever conduit runs extend from heated to unheated areas, condensation problems will immediately develop due to the difference in the dew points of the two areas. Many contractors make a practice of sealing off all conduits extending from heated to unheated areas or rooms to prevent the passage of heated air through the raceway to colder portions of the building where the warm air will cool and give off moisture. When such a condition exists, either explosion-proof sump condulets should be installed at the lowest point on the conduit run or the conduit should be sealed between the heated and unheated rooms.—G.R.

YARD LIGHTING

Q. "When installing yard lighting for residential property, is it permissible to bring the conductors for such lighting out through the service raceway?"—B.S.

A. No! Section 2308 of the National Electrical Code prohibits such practice. Only service conductors, grounding conductors, or control conductors from time switches having overcurrent protection may be installed in service raceways.—G.R.

SOLDERLESS CONNECTORS

Q. "In the August issue of Electrical Contracting under the section on Code Questions, there is a question on solderless connectors, and in the answer Mr. Squires mentions the fact that the strands should not be

cut away to fit smaller lugs than specified.

"For some time one company has furnished on certain type compensators, solder lugs much smaller than the rated size wire requires and if these are used it is always necessary to cut some of the strands out.

"Most other makers of compensators furnish lugs sufficiently large to accommodate the required wire sizes.

"It seems to me if this is continued, sooner or later some of these installations will run afoul of an inspector who will call the hand on the installer. Please let me have your opinion since this problem has come up a number of times."—J.A.R.

A. Just because a manufacturer sends out equipment with solder lugs which are too small to accommodate the proper size wires required for the motor, is no excuse for cutting away any of the strands of the cable so as to use the too small lugs.

Our opinion is still the same, the strands must not be cut off.

Of course it sometimes happens that wires of sizes larger than those required by the Code are used in order to avoid voltage drop, in which case this fact should be mentioned in the order, so that proper lugs may be furnished.

Underwriters' Laboratories advise that they require that where lugs are furnished with such devices, that the lugs be of proper size to take the wires required by the Code.—F.N.M.S.

REWIRING A BREWERY

Q. "Following completion of a partial rewiring job in a brewery in a nearby town, I have been mailed a rejection slip by the Inspector stating that the circuit run through the malt sprouting room was not properly supported. This was a feeder circuit consisting of three No. 6 wires in cable form covered with a rubber sheath supported by porcelain insulators attached to a concrete ceiling by brass screws and braided fibre plugs. The maximum distance between these supports was well within the 4½ feet required by Code. What shall I tell this Inspector?"—J. Q.

A. Here again is an example of the real need for inspectors to place the section of the Code which covers the violation upon the rejection slip. Many electrical contractors could keep their blood pressure down if they were told just where they erred.

Non-metallic waterproof wiring should be supported at intervals of not

more than three feet. See Section 3404 of Article 340. Apparently all you can do is to drill some more holes and hang more insulators.—G.R.

OUTLET BOXES

Q. "We recently wired an auto garage with thin wall where the office and sales floor were finished with ½ inch thick wallboard. The boxes could not be set flush with this wallboard unless the thin wall was brought in from the back which would have increased the cost of the job considerably. What is the best solution to such a problem, and does the Code make it mandatory that the boxes be flush with such finish?"—L.K.

A. Now that the installation is in, probably your best solution is to use extension rings on the boxes mounted behind the wallboard. The National Electrical Code, under Section 3711, definitely requires that in walls or ceilings constructed of wood or other combustible material, outlet boxes shall either be flush with the finished surface or project therefrom.—G.R.

GROUNDING MOTOR

Q. "What size grounding wire must we use to ground the frame of a 50 horsepower three phase 440 volt induction motor?"—E.P.

A. The answer to your question is found under Section 2595 of the National Electrical Code and is No. 6 AWG conductor, one-half inch conduit or one inch electrical metallic tubing. The size of the grounding conductor is determined by the rating or setting of the overcurrent device in the circuit ahead of the equipment to be grounded and by reference to the table contained in this section the proper size of grounding medium may be readily found.—G.R.

SOLDER LUGS FOR TERMINAL

Q. "Does the Code prohibit the use of solder lugs for terminals on No. 4 or larger conductors?"—L.W.

A. No, the National Electrical Code does not prohibit the use of solder lugs at terminals. Section 1116 of the Code reads as follows: "Connection of conductors to terminal parts shall insure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors (including set

screw type), solder lugs or splices to flexible leads either soldered, brazed or welded, except that No. 8 or smaller solid conductors and No. 10 or smaller stranded conductors may be connected by means of clamps or screws with terminal plates having upturned lugs. Terminals for more than one conductor shall be of a type approved for the purpose". Many inspection authorities have special rulings more stringent than those contained in the Code, and it is not uncommon to find special rulings in certain cities which require the use of pressure type connectors at terminals.—G.R.

SERVICE ENTRANCE SWITCH

Q. Does the service entrance switch installed for the operation of a fire pump have to be located adjacent to the other service equipment supplying the building?"—M.K.

A. No. While it is generally true that service equipment must be grouped, there are exceptions to this rule and this is one. Section 2352, which requires grouping, also refers to the exceptions which will be found in Sections 2302-c and 2321 of the National Electrical Code. Under these sections are found services for fire pumps, emergency lighting, buildings of large area, multiple occupancy buildings and capacity requirements.—G.R.

S. E. VS. A. S. E. CABLE

Q. "We recently accepted a job requiring the installation of type A.S.E. service cable and when completed, we received a rejection slip stating that this service cable was type S.E. instead of type A.S.E. When this material was purchased, we understood that it was an armored service cable, and it did have a metal ribbon armor wrapped spirally about the conductors. Can you explain the difference between this cable and type A.S.E. cable?"—L.J.

A. Type A.S.E. cable has an interlocking armor covered by a non-metallic outer jacket and type S.E. cable does not necessarily have any metallic covering over the conductors. In an attempt to give some protection from mechanical abuse and also to stop tampering and current theft, some manufacturers of type S.E. cable have produced cables similar to the kind you have mentioned. The fact that this ribbon covered cable is often sold as an armored type S.E. cable is confusing to many persons.—G.R.



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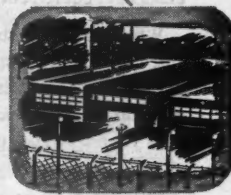
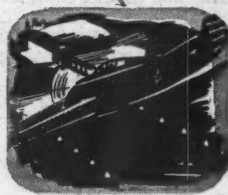
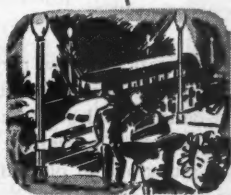
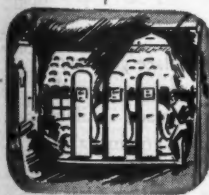
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Electrical Contracting, October 1944

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Controllers for Wound-Rotor Motors—I

Characteristics of the wound-rotor motor which makes it adaptable to external control is explained in this first article on the selection and application of wound-rotor motor controllers.

THE wound-rotor, or slip-ring, motor is similar in many respects to the squirrel-cage motor; but with the wound-rotor motor it is possible to obtain a number of desirable results that cannot be obtained with the squirrel-cage type.

The initial starting current of the wound-rotor motor may be held to almost any desired value, and the motor may be accelerated gradually in any desired number of steps. The available starting torque is high, but it can easily be reduced to the amount most suitable for the driven machine. Speed regulation is readily obtained with positive loads, and by slightly more complication of the control, with negative loads. The motor is therefore best suited to those applications requiring high starting torque, low starting current, and speed regulation.

When studying the operation and application of the wound-rotor motor, and the methods of controlling it, it is helpful to start with a consideration of the squirrel-cage motor. The stator construction of the two motors is the same, being a laminated framework into which are wound insulated wire coils. The coils are arranged to form one or more pairs of magnetic poles, depending on the motor speed desired.

When such a winding is connected to a three-phase power supply there results a magnetic field which is uniform in strength, and which rotates around the stator winding at a speed determined by the supply frequency and the number of pairs of poles.

$$\text{Synchronous speed in rpm} = \frac{60 \times \text{Frequency}}{\text{Pairs of Poles}}$$

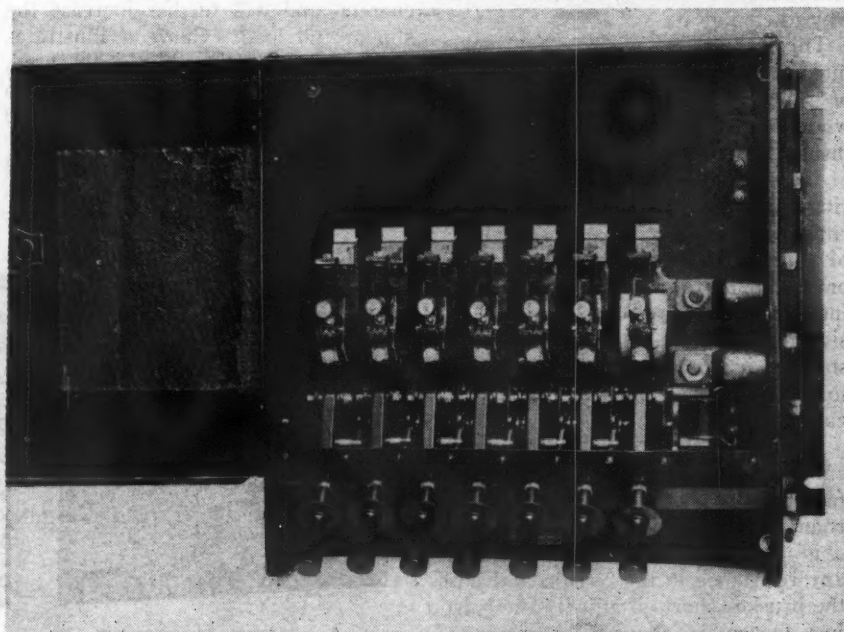
The rotor of the squirrel-cage motor is also a laminated structure, having

By P. B. Harwood,
Manager of Engineering
Cutler-Hammer, Inc.
Milwaukee, Wisconsin

slots in which copper or aluminum bars are placed. The bars are all connected together at each end of the rotor by means of a connecting ring. The slots are approximately parallel to the motor shaft, but are generally skewed somewhat to reduce magnetic vibration and to insure a uniform torque in all rotor positions. There are no connections made to the rotor, nor is there any way to vary the characteristics of the squirrel-cage, once the design has been determined and the

rotor built. The resistance of the squirrel-cage may be very low, as would be the case if low resistance short-circuiting end rings were used. The resistance may also be relatively high, if a higher resistance material is used for the end rings. The amount of resistance in the rotor makes quite a difference in the operating characteristics of the motor.

When power is applied to the stator winding, and a rotating magnetic field is established, the rotor becomes essentially the secondary of a transformer, and a voltage is induced in the squirrel-cage. Current flows in the rotor bars, magnetizing the rotor, and causing it to begin to turn in the direction in



MULTIPLE-SWITCH type of starter designed for use in the rotor circuit of a wound-rotor motor.

which the stator field is revolving. If this were a two-pole, 60 cycle machine, the speed of the rotating field would be 3600 rpm, and at standstill each rotor bar would be cut by the magnetic field 3600 times per minute. The induced voltage would therefore be relatively high. As the rotor increases its speed, the rate of cutting the field becomes less and less, until, if the rotor could reach 3600 rpm, it would be traveling at the same speed as the rotating field. There would then be no induced voltage. However, there would also be no induced current, the rotor would not be magnetized, and there would be no turning torque. For this reason the motor cannot quite attain synchronous speed, but will run at a speed just enough below synchronism to permit an induced current which will provide the necessary torque. The difference between synchronous speed and the actual running speed is called slip.

Running speed in rpm =

$$\frac{60 \times \text{Frequency}}{\text{Pairs of Poles}} - \text{Slip}$$

The starting torque of the motor will be determined by the resistance of the rotor. A low-resistance rotor will draw a high starting current, will have a relatively low starting torque, and will have a low slip. A high-resistance rotor will draw less starting current, but will have a higher starting torque, and will have a higher slip. For many applications, low starting current and high starting torque, combined with low slip when running, are desired. In other words, the rotor resistance should be high when starting, and low when running, but one or the other must be selected, and there is no way to change it.

This is where the wound rotor comes into the picture. Instead of using a set of short-circuited bars, the rotor is wound with a wire or strap winding of insulated conductors, and the terminals of the winding are brought out to slip rings. Stationary brushes ride on the rings, and so provide a means either of short circuiting the rotor winding, or of connecting external resistance into the winding. The external resistance may be inserted to provide low starting current and high starting torque, and may then be short circuited to provide a low running slip.

Figure 1 shows the speed-torque curves for a slip-ring motor with different values of external resistance connected into the rotor circuit. Curve *a* is that of the motor alone, without any resistance in the circuit, and with the brushes short-circuited. The starting torque is about 72 percent of rated torque, and the starting current is about 350 percent of full-load cur-

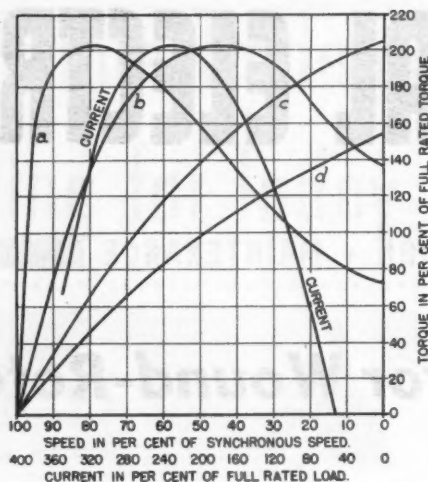


FIG. 1 Characteristic curves of a wound-rotor motor.

rent. Note that the slip, or drop in speed at full load, is about three percent. When a small amount of resistance is introduced into the rotor circuit, characteristics as shown by curve *b* are obtained. The starting torque is much higher, being about 138 percent, although the starting current is actually lower, being about 320 percent. The slip at full load is now about 14 percent, which might be objectionable when running, or might be desirable as a means of obtaining a reduction in the running speed. Curve *c* shows the conditions when just enough resistance has been added in the rotor circuit to give the maximum possible starting torque of about 204 percent. The starting current is still lower than before, being 230 percent. The slip at full load is about 33 percent. Any further increase in resistance will reduce the starting torque as well as the starting current, and will further increase the slip at full load. Curve *d* illustrates a starting condition frequently used, where enough resistance is inserted to allow a starting current of about 150 percent, and a starting torque of approximately 155 percent of the rated value. With this amount of resistance

in circuit and with full load, the motor will run at half speed.

It is now possible to determine the methods by which the motor may be controlled. The functions which are commonly required of a controller are:

Start the motor without damage or undue disturbance to the motor, driven machine, or power supply.

Stop the motor in a similarly satisfactory manner.

Reverse the motor.

Run at one or more selected speeds below synchronous speed.

Run at speeds above synchronism.

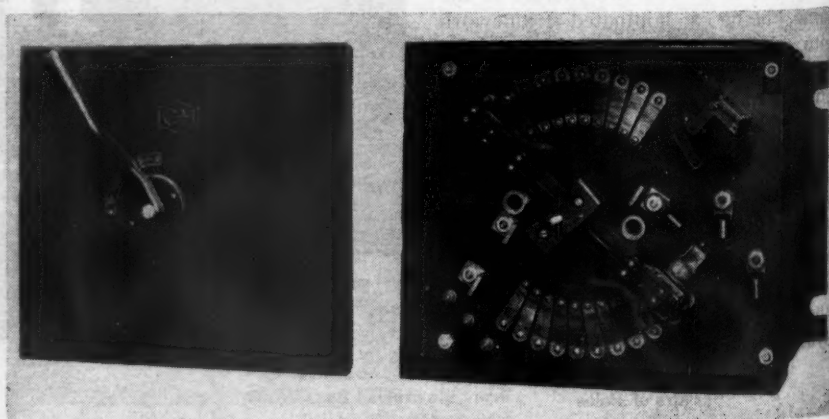
Satisfactorily handle an overhauling load.

Protect the motor.

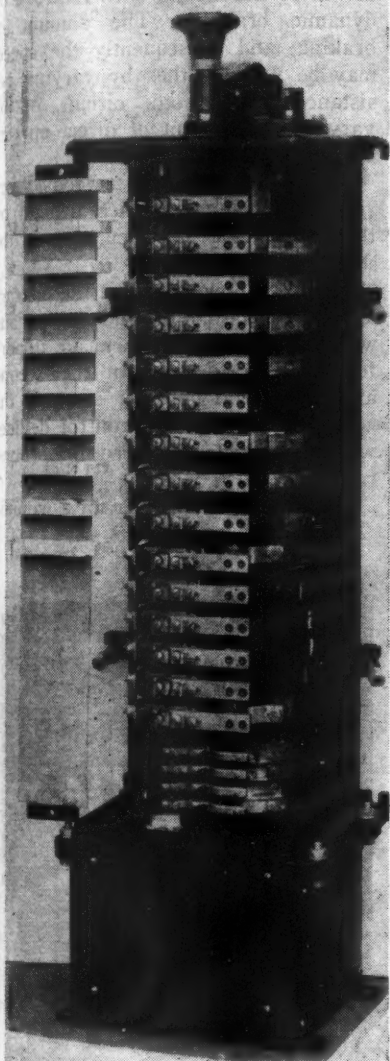
Starting

To start the motor, a means must be provided for connecting the stator circuit to the power supply lines. This may be a safety knife switch, a circuit breaker, or one of the manual or automatic across-the-line type starters used to start squirrel-cage motors. Then there must be a control for the rotor circuit, consisting of a bank of resistor material and some means of short circuiting the resistor in one or more steps. Either or both stator and rotor controls may be manually operated, or may be magnetic devices automatically operated.

Referring to Fig. 1, and assuming the motor to be fully loaded, the starting resistor will be designed to give an initial starting torque as shown by curve *d*. With all resistance in circuit, and with the stator circuit closed, the motor will start, and will accelerate to approximately 50 percent speed. At this point the torque will have dropped to 100 percent, or just enough to keep the load moving, and the motor will not be able to accelerate any farther. At that point, or slightly before it, some of the resistance must be short-circuited to again increase the torque to about the initial value. The motor will then continue to accelerate follow-



FACE-PLATE TYPE of starter for the rotor circuit of a wound-rotor motor.



MANUALLY-OPERATED drum controller.

ing a new curve somewhat like curve *c*, until the torque again drops to 100 percent. Another step of resistance must then be short-circuited, and so on until the resistance is all cut out of circuit, and the motor is operating on curve *a*.

If the starting load on the motor is always less than full load, the initial starting torque may be reduced, or it may be left at the same value and the motor accelerated in a less number of steps depending upon the requirements of the application.

Stopping

Ordinarily a wound-rotor motor is stopped by simply disconnecting it from the power supply and letting it coast to rest. When a quick stop is desired, the motor may be equipped with a magnetically operated brake, which is released by a magnet or a solenoid when the motor is running, and set by a spring when the motor is disconnected. Some few installa-

tions have used a form of dynamic braking, obtained by connecting direct current to one phase of the stator, but this is not common.

Many installations require a slow-down before stopping, and this is readily obtained by reinserting all or part of the starting resistance before disconnecting the stator circuit.

Reversing

The motor may be reversed by reversing any one phase of the stator circuit.

Speeds Below Synchronism

The curves of Fig. 1 show that speeds below synchronous speed may be obtained by connecting resistance into the rotor circuit. If enough resistance were used to give performance curve *d*, the motor, if fully loaded, would run at about half speed. If it were only half loaded, it would run at about 78 percent speed. With some resistance cut out, so that curve *c* applied, the fully loaded motor would run at 65 percent speed. Similarly any desired speed at any given load may be obtained. The ohmic value of the resistor required in each of the three phases may be calculated from the equation

$$R = \frac{E \times S}{1.73 I}$$

R = resistance in ohms

E = rotor volts at standstill

S = slip, or amount of speed reduction expressed as a fraction of the synchronous speed.

I = rotor current in amperes at the reduced speed.

The actual current at the desired speed must be known, as this may be quite different from the motor's rated F. L. current. For example, consider Fig. 2, which shows the curves for a centrifugal pump. The initial torque required to pump water is very low, the hump in the curve being the break-away torque required. Once started, the required torque drops at first, then rises as the pump accelerates. With a resistor designed to allow 100 percent current at the start, the motor

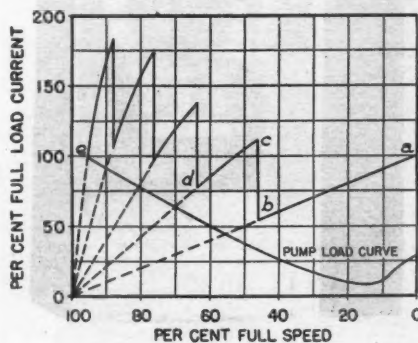


FIG. 2 Acceleration curves of a centrifugal pump.

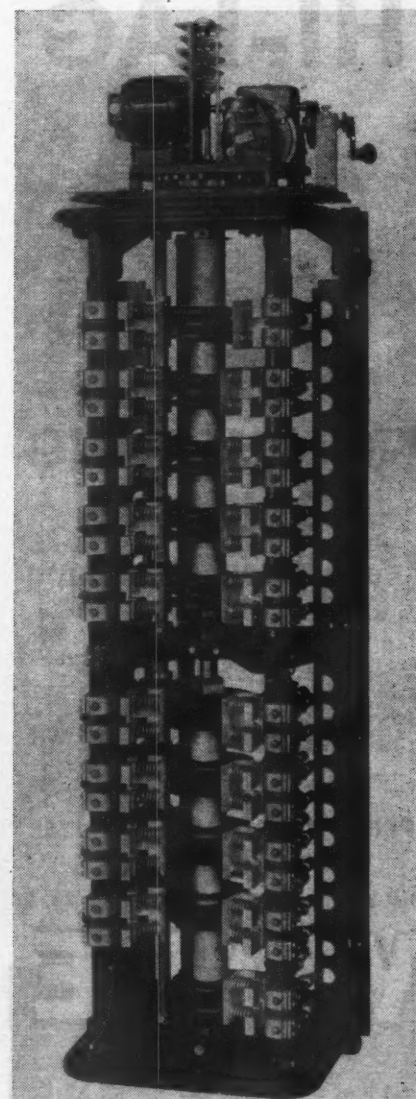
will accelerate to about 55 percent speed and run there. If the motor were driving a machine that required 100 percent torque to start it, the motor could not start at all with the same resistance in circuit.

Speeds above Synchronism

Speeds above synchronism cannot be obtained when driving a positive load. With an overhauling load, and with the rotor slip-rings short-circuited, the motor will run slightly above synchronous speed. If external resistance is then inserted in the rotor circuit, the speed will be increased.

Overhauling Loads

Many cranes which must lower heavy loads safely are equipped with wound-rotor motors. Some of the cranes are equipped with gearing which is non-overhauling. Other cranes use a load brake, which is a device that permits lowering at safe speeds but applies a brake if the speed exceeds a desired value. There are

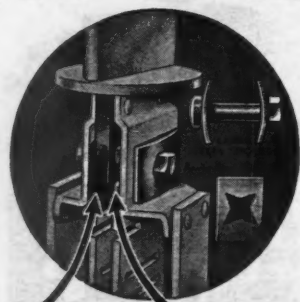


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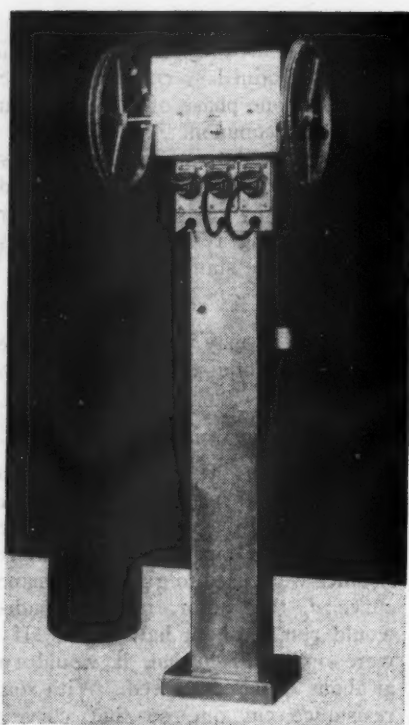


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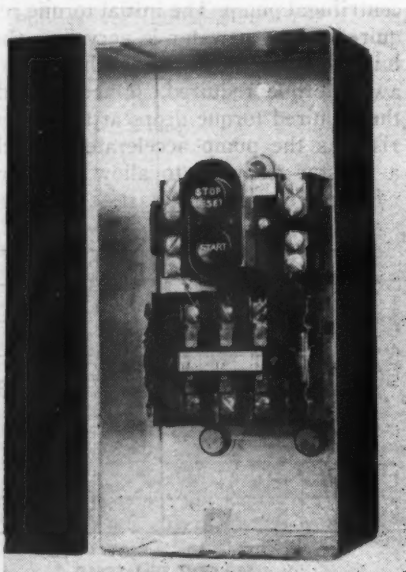
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MULTI-POINT float-operated pedestal-type switch

also several electrical methods of obtaining reduced speeds with an overhauling load. An arrangement known as reverse-torque lowering, or plugging lowering, first connects the motor to the power lines and starts it in the down direction, then reverses the motor, at the same time inserting a high resistance in the rotor circuit. The motor is then exerting a torque tending to hoist the load, but not strong enough to do so. The load continues to lower, but at a reduced speed depending on the amount of hoisting, or braking, torque exerted.

Reduced speeds may also be ob-



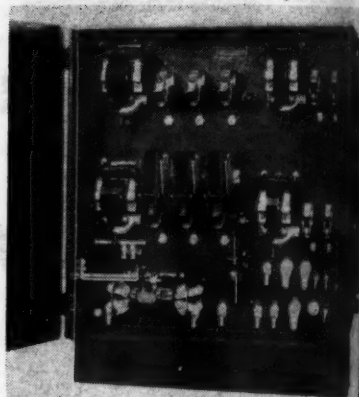
MANUALLY-OPERATED switch for stator circuit.

tained by applying direct current to one phase of the stator. The rotor is driven by the load, is then retarded by dynamic braking. The amount of braking, and consequently the speed, may be varied either by varying the resistance in the rotor circuit, or by varying the amount of direct current supplied to the stator.

There are also other methods, more recently developed, which depend on the unbalancing of the currents in the stator.

We have now discussed the characteristics of the motor, and the various ways of controlling it to make it perform as we desire. In the second article we will consider some of the actual controllers and control devices which are generally used for wound-rotor motors.

In general, a controller for a wound-



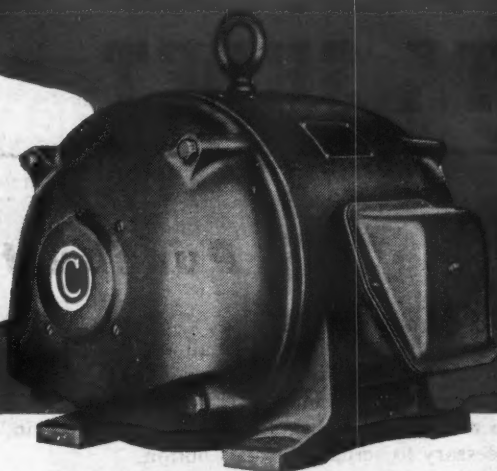
MAGNETIC controller for a wound-rotor motor.

rotor motor will consist of some form of switch used to connect the stator to the power supply lines, a bank of resistor material connected into the rotor circuit, and some means of short-circuiting the resistor in one or more steps. Protection against overload is usually provided.

For a three-phase motor, the stator switch will be a three-pole, single-throw device. Where reversing is desired it will be three-pole double-throw. For manual operation it may be an enclosed knife switch or a circuit breaker. Manually-operated switches similar to snap switches, but equipped with an overload relay, are available for motors of $7\frac{1}{2}$ horsepower or less. Where remote control is desired, either from push buttons or from some automatic pilot device like a float switch or pressure regulator, it is common practice to use one of the familiar across-the-line starters used for squirrel-cage motors.

The control for the rotor circuit may also be either manually-operated or may consist of a set of magnetic contactors automatically controlled.

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DATA SHEET

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Pushbutton Circuits

Low-voltage protection allows all apparatus to be disconnected from the line if the power source fails or a disturbance occurs that causes the line voltage to drop to a very low value. In order to start again, it is necessary to actuate the start button.

Low-voltage release, on the other hand, allows all parts to be disconnected from the line if for any reason the power source voltage is inadequate, but when the voltage again reaches sufficient value the control will function automatically to connect the apparatus to the line through the proper starting sequence.

These two types of control circuits, commonly known as two- and three-wire control, require different types of pushbuttons. The low-voltage release control circuit requires a pushbutton that remains closed until released by hand. This type of pushbutton

is known as the maintained type, and the contacts are held closed mechanically. Low voltage protection is secured by a momentary-contact type pushbutton.

Any combination of control sequence for low-voltage protection can be obtained by applying these two fundamental rules:

1. Wire all stop buttons in series with the holding coil, with each other, and with the electrical interlock.
2. Wire all start buttons in parallel with each other and with the electrical interlock.

In the accompanying diagrams number 1 has been used to designate the control circuit to the start button; 2, the point common to the start-stop button; and 3, the stop button. The holding interlock parallels the start button; therefore, in the schematic diagrams it is connected to points 1 and 2 of the pushbuttons.

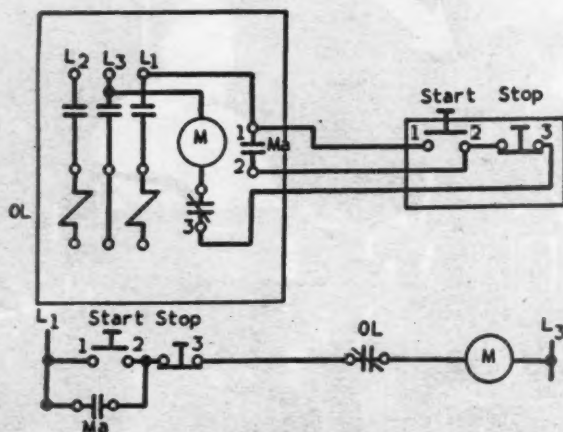


Fig. 1

Buttons: Two momentary-contact, one closed, one open.
Circuit: Low-voltage; protection, single station.
Duty: Start-stop.

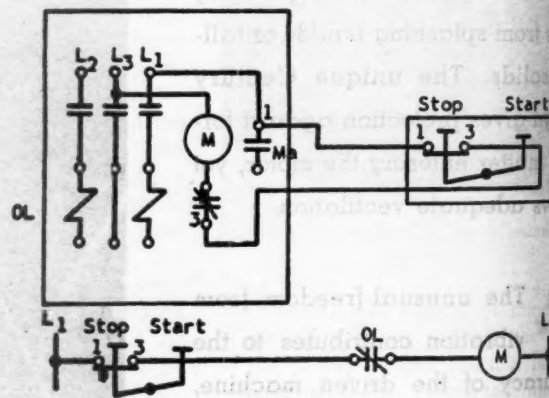


Fig. 2

Buttons: Two maintained-contact.
Circuit: Low-voltage release, single station.
Duty: Start-stop.

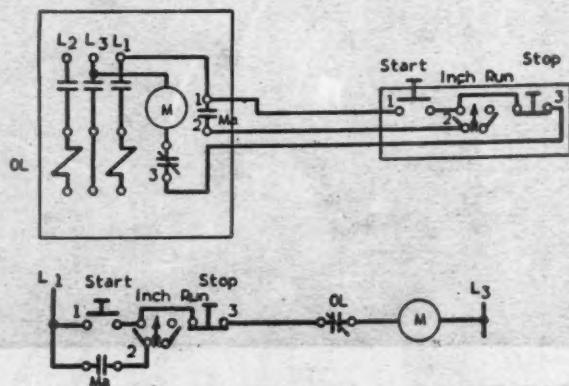


Fig. 3

Buttons: Two momentary-contact and one selector switch.
Circuit: Low-voltage protection plus inching.
Duty: Start-run, inch-stop.

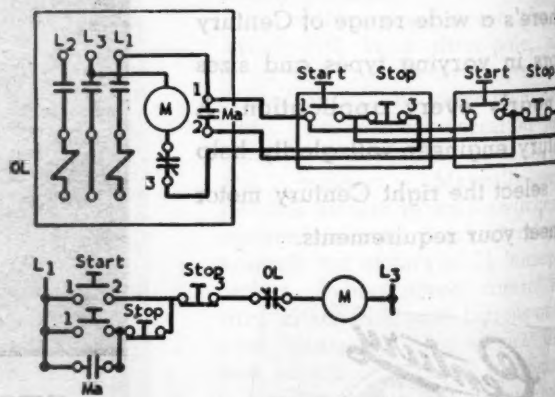


Fig. 4

Buttons: Four momentary-contact, two open, two closed.
Circuit: Low-voltage protection, two stations.
Duty: Start-stop, start-stop.

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C-5

Pushbutton Circuits (Continued)

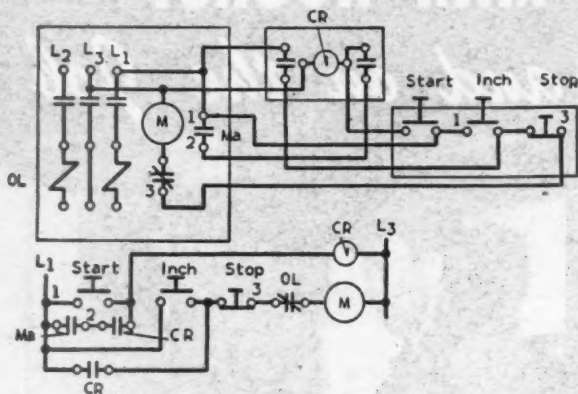


Fig. 5

Buttons: Three momentary-contact and inching relay.
Circuit: Low-voltage protection plus foolproof inching.
Duty: Start-inch-stop.

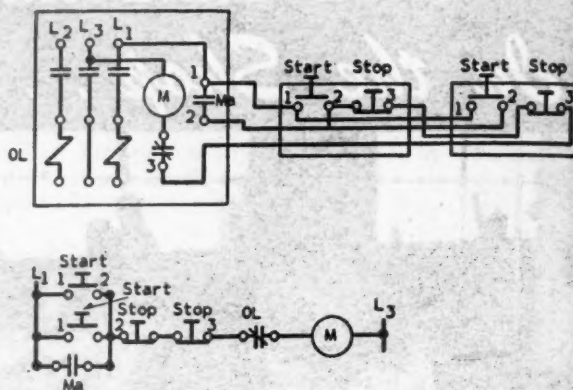


Fig. 6

Buttons: Four momentary-contact, two closed, two open.
Circuit: Low-voltage protection, two stations.
Duty: Start-stop, start-stop.

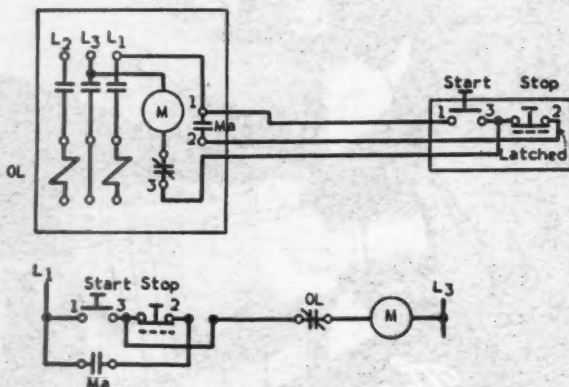


Fig. 7

Buttons: Two momentary-contact, one open, one closed with safety latch.
Circuit: Low-voltage protection.
Duty: Start-stop (On inch for latch).

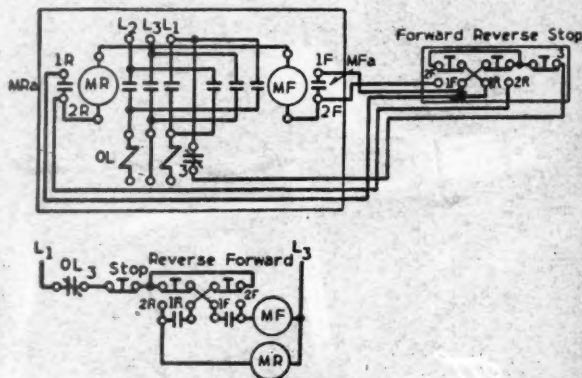


Fig. 8

Buttons: Three momentary-contact, two open, one closed.
Circuit: Low-voltage protection, interlocked through push-buttons.
Duty: Forward-reverse-stop.

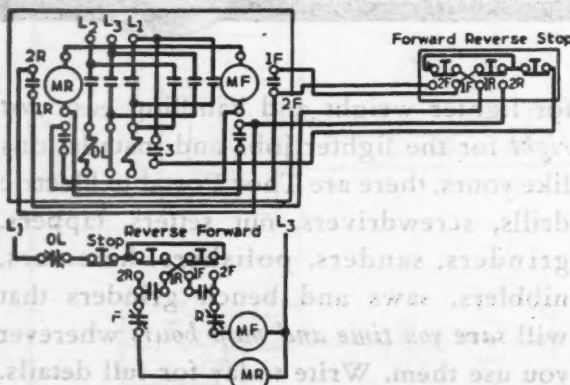


Fig. 9

Buttons: Three momentary-contact, two open, one closed.
Circuit: Low-voltage protection with electrical interlocks.
Duty: Forward-reverse-stop.

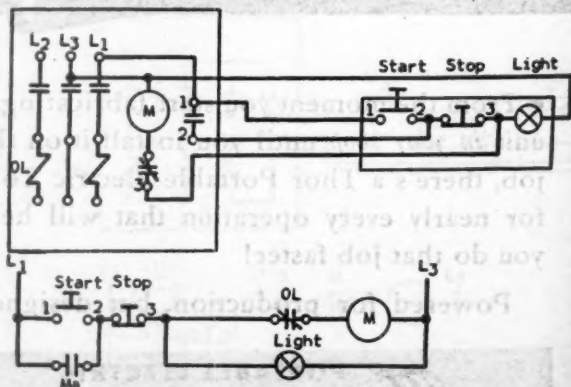


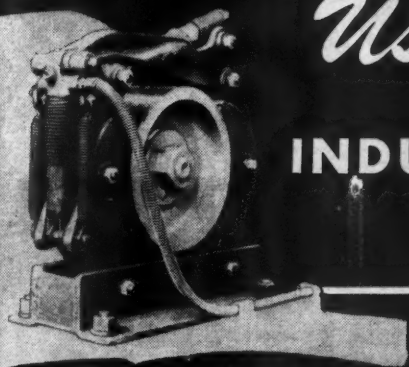
Fig. 10

Buttons: Two momentary-contact, one indicating light.
Circuit: Low-voltage protection.
Duty: Start-stop.

Data from L. E. Markle, Westinghouse Electric and Mfg. Co.

Use Wagner

INDUSTRIAL BRAKE CONTROLS



wherever
industrial machinery must be stopped
quickly, safely, and smoothly

A typical crane bridge-braking system as used on overhead cranes is illustrated. It consists of an external brake, which is actuated by a foot-operated master cylinder. The same system has been successfully applied to other machines, such as bending-rolls, scrap-balers, large wheel-balancers, and similar applications depending on foot pressure to decelerate the machine for either normal or emergency stops.

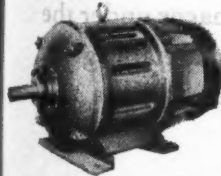
Wagner manufactures many other brake controls which may be applicable to your machines. These may be either air or hydraulically actuated. A general idea as to what these controls are may be obtained by referring to the illustrations shown on this page. However, types of applications for dependable brake control are numerous and very often difficult to determine. We suggest that you consult us and benefit by the recommendations of our trained and experienced brake engineers.

HYDRAULIC ACTUATOR CYLINDER

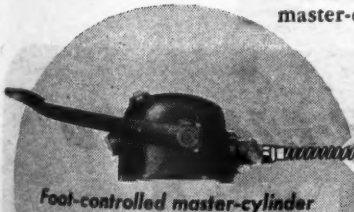


One of several types of hydraulic actuating-cylinders which transforms the hydraulic-fluid pressure into the mechanical force needed to apply the brake shoe against the brake wheel or drum.

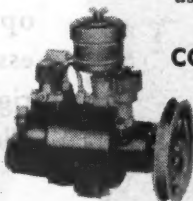
MOTOR and BRAKE UNIT



Each unit is equipped with an internal expanding shoe-type brake that is applied by hydraulic pressure developed in a foot-operated master-cylinder.



Foot-controlled master-cylinder



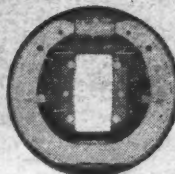
AIR COMPRESSOR

The function of this unit is to develop and maintain sufficient compressed air in air reservoir to operate air-brake system and other air-powered accessories.



TYPE HM BRAKE

Wagner Type HM Hydraulic Industrial Brake is intended for use on overhead cranes, whirler cranes, coke pushers, lorry cars, door machines, and transfer cars which require a parking brake when out of service or while performing their principal functions.



TYPICAL WAGNER LOCKHEED INTERNAL BRAKE

A typical Wagner Lockheed internal brake assembly. Available in various sizes for application to some types of industrial machinery. Wagner engineers will advise you whether this type of brake can be applied to your machinery.

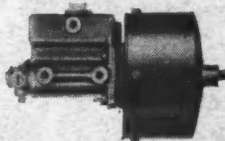
AIR CYLINDER

This Wagner air power-cylinder assembly converts the energy contained in compressed air into mechanical force, which (through linkage) expands the brake shoes in mechanical brake systems or actuates the hydraulic master-cylinder in air-hydraulic brake systems.



POWER CLUSTER

The Wagner Power Cluster simplifies the application of air power to hydraulic brake systems. It consists of a standard air power-cylinder assembled directly to a standard hydraulic master-cylinder. It produces desired hydraulic line-pressure by varying the air pressure without the use of levers or linkage.



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144-13

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ESTABLISHED 1891

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ELECTRUNITE Steeltubes is the electrical metallic tubing made from open-hearth steel, specially processed in Republic furnaces under the rigid control of their metallurgists. This steel is uniformly ductile and



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Republic "INCH-MARKED"

ELECTRUNITE

Steeltubes

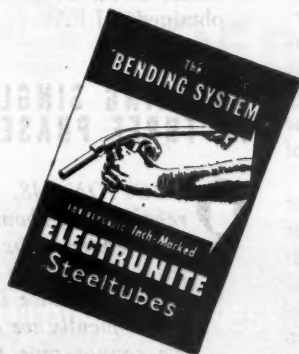
...some prefer the other

TO MAKE ACCURATE BENDS WITH

Steeltubes

free from hard spots, so when converted by the ELECTRUNITE process of manufacture, it becomes tubing which bends smoothly and freely to any needed shape.

Many methods of bending and types of bending equipment are described in the pocket-size bending manual, "The Bending System for Republic 'Inch-Marked' ELECTRUNITE Steeltubes". It also includes information on Steeltubes which will help you do better work with less effort. If you don't have a copy, ask your ELECTRUNITE Distributor or write us for one.



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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay \$5.00.

READER'S QUIZ

MEASURING RESISTANCE

QUESTION 147. I have a pole-line ground the resistance of which I would like to measure. There are two other separate grounds nearby that I can use to check with. I believe there is an instrument on the market that uses some method to figure ground resistances. I would like to know how it is done and what formulas are used.—F.G.K.

A. TO QUESTION 147. There are several instruments on the market which read ground resistance directly on an ohm scale, and require no calculations. In each case, the instrument has to be connected to the unknown ground and to two independent auxiliary grounds being at least 60 feet apart from each other and from the ground to be tested. All instruments use alternating current as source, to avoid d.c. polarization effects, and all instruments use a.c. at a frequency different from 60 cycles, to avoid interference from industry stray currents. In some types, the a.c. is produced by cranking a magneto; in others, it is derived from d.c. over a vibrator, like in an automobile radio.

When no ground resistance meter is available, an approximate determination can be made by measuring the series a.c. resistance of any two of the three-electrodes. This can be done with voltmeter and ammeter, using an ungrounded low voltage as source (6 or 12 volts from a bell ringing transformer). Let the unknown ground resistance of the object be R_1 , that of the two auxiliary electrodes R_2 and R_3 . Then, one measures

$$\begin{aligned} A &= R_1 + R_2 \\ B &= R_2 + R_3 \\ C &= R_3 + R_1 \end{aligned}$$

$$\text{from which } R_1 = \frac{A - B + C}{2}$$

The drawback of this method is that the unknown resistance is determined from the resistance of all three electrodes. If the resistance of the auxiliary electrodes is high (which is usu-

ally the case) the unknown resistance can be quite wrong.

Example: The actual values are

$$\begin{aligned} R_1 &= 20 \text{ ohms} \\ R_2 &= 200 \text{ ohms} \\ R_3 &= 400 \text{ ohms} \end{aligned}$$

Hence one should measure

$$\begin{aligned} A &= 220 \text{ ohms} \\ B &= 600 \text{ ohms} \\ C &= 420 \text{ ohms} \end{aligned}$$

Actually, however, a typical measurement might be:

$$\begin{aligned} A &= 195 \text{ ohms} \\ B &= 605 \text{ ohms} \\ C &= 415 \text{ ohms} \end{aligned}$$

from which one obtains

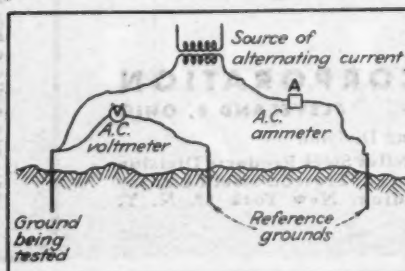
$$R_1 = \frac{195 - 605 + 415}{2} =$$

$$2.5 \text{ ohms (instead of 20 ohms)}$$

The commercial instruments avoid this shortcoming. The resistance of the auxiliary electrodes affects the sensitivity but not the accuracy. Auxiliary resistances up to 1000 ohms and more are permissible without undue error.—L.F.R.

A. TO QUESTION 147. At best, measurement of ground resistance gives only a reference figure which can be compared to other figures which have been found satisfactory from experience. The factors entering into any test include stray earth currents, resistance of ground rod, resistance between the ground rod and adjacent earth, resistance of auxiliary ground, earth resistance between the two grounds, buried pipes, closeness of reference grounds, etc.

A recommended ammeter-voltmeter method is shown on the sketch. For best results, the reference grounds should be at least 25 feet apart, and located as nearly in a straight line as possible. The reference grounds need



not be driven more than three feet into the earth.

The formula used is: $R = E/I$.

Instruments on the market, known as ohmmeters are self-contained generators. The scale is calibrated to read directly, the formula being automatically solved.—L.E.B.

A. TO QUESTION 147. There are special ohmmeters available which will read ground resistance direct. Some instruments operate on the drop in potential or potentiometer principle. Here a current is passed through the ground between the ground electrode, of which the resistance is to be tested, and a reference or auxiliary ground. The drop in potential from the ground electrode to a second reference ground is then measured by means of a voltmeter. If the current through the ground is measured, the resistance can be calculated as $R \text{ resistance} =$

$$\frac{E \text{ volts}}{I \text{ Amperes}}$$

I Amperes

When the special instrument is used, one coil carries the earth current and the other carries current proportional to the drop in potential. The ratio of these opposing torques is shown by the indicator and a direct reading in ohms is obtained.—J.E.W.

CHANGING SINGLE PHASE TO THREE PHASE

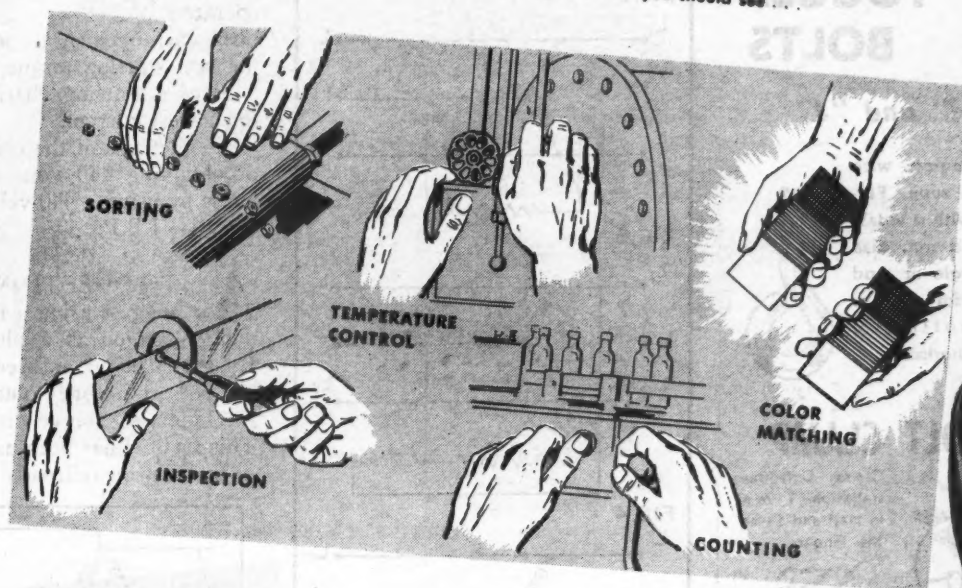
QUESTION 148. In our motor repair shop, about 50 percent of the rewind jobs are 3 phase, from 1 to 15 hp. Three phase, 220 volt service is not available. Consequently we are at a loss as we cannot give these motors a running test since we have only single phase at 220 volts. Is there any practical way to change single phase to three phase without installing a single to three phase m-g set?—H.G.H.

A. TO QUESTION 148. A practical and easy way to convert power from single-phase to three-phase

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In the illustration below five pairs of hands are busily engaged in five typical factory operations. Each instance is an example of waste labor! Electronic equipment can do these jobs faster, cheaper, more accurately—and release those hands for more productive labor—with the end result of lower production costs . . . lower consumer prices . . . more output—and more jobs!

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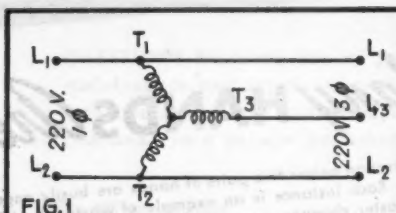


FIG. 1

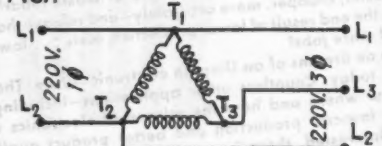


FIG. 2

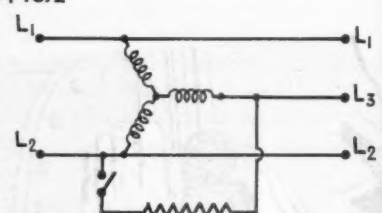


FIG. 3

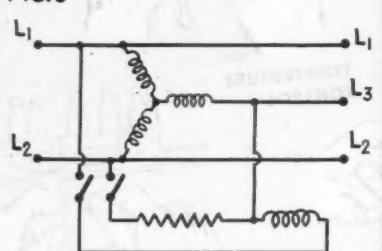


FIG. 4

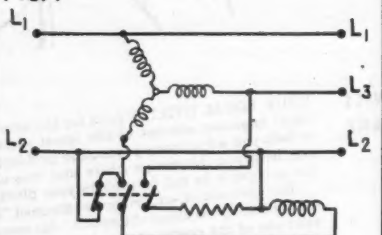


FIG. 5

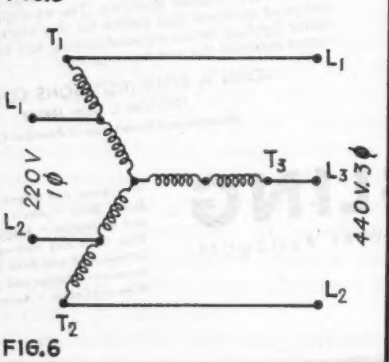


FIG. 6

(or two-phase if required) is to operate a three-phase motor on single-phase, and taking the three-phase power from its leads.

Either a wye or delta connected motor may be used, and as can be seen from Figs. 1 and 2, one phase does not require any transformation, so the capacity of the "converter" must be two-thirds as great as the amount of three-phase power required. Thus, a 10 hp., 220 volt, 3 phase motor could be used for the 15 hp. test. It is essential that the air-gap be uniform so as not to

cause too great an unbalancing of the voltages. The voltages L_1 to L_2 and L_2 to L_3 will be slightly lower than L_1 to L_3 , but this will not make any appreciable difference in the test readings.

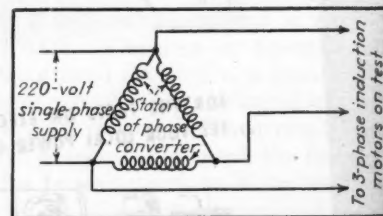
The converter can be started mechanically or from the single-phase side.

If there is no objection to a momentary high starting current, the arrangement as per Fig. 3 would be the simplest and with a little experimenting with the resistance value, optimum torque can be determined. The switch can be either manually or centrifugally operated.

The arrangement as per Fig. 4 gives the best starting torque, whereas Fig. 5 gives a starting characteristic with the lowest current.

Another use of the converter is that of obtaining 440 volts 1-phase or 3-phase by using a 440 volt motor as per Fig. 6.—J.B.P.

A. TO QUESTION 148. I would suggest using a three-phase induction motor as a phase converter. By this method a three-phase supply can be satisfactorily obtained from the single-phase source now available. This method has been used extensively in the past on railroads for converting



the single-phase on the trolley wires to three-phase for driving the locomotive.

A slight unbalance in voltages is usually noticed; this is adequate for testing motors, especially so where the power required is not so great.

Connections are as shown in the schematic diagram above.—R.L.M.

A. TO QUESTION 148. If H. G.H. has a large three-phase motor, he can run it to get his three-phase test voltage. He has stated that his rewinds are all below 15 hp., so the single phase 220 volt power service should be large enough to run the test.

Of the several methods possible to start a three phase motor on a single phase line, the most practical would be to cut resistance across two phase windings momentarily where special devices are not at hand. The large motor acts as an induction generator, excitation from the line.—E.J.K.

A. TO QUESTION 148. Get a 20 hp., three phase motor and a 1/2 hp., single phase motor and belt them together. Throw the 1/2 hp. motor on the line first to start the 200 hp. motor.

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ROTOR

Rotor is of all welded construction. The core is built of electrical sheet steel punchings having partially closed slots. The winding is made from hard drawn copper strip driven into the slots. The ends of the rotor bars are welded to copper or alloy end rings. These rotor bars also provide fan action for efficient ventilation.

STATOR

Coils are form wound, diamond shaped interchangeable and carefully insulated with selected materials. Core is built of accurately punched mill varnished, motor special, electrical sheet steel.

LIFTING LOOP

All sizes have large lifting loop to accommodate crane hook for easy handling.

FRAME

Constructed of rolled steel rings with heavy cross ribs, angle type web feet and electrically welded.

BRACKET & BEARING

Bracket is cast iron, simple design, providing rugged bearing support with ample lubrication and a minimum of parts and machined fits.

VENTILATION

Cooling air, circulated by rotor bar fan is taken in through bracket openings and discharged at the center frame opening.

SHAFTS

Shafts are large and well proportioned of 30-40 carbon steel.

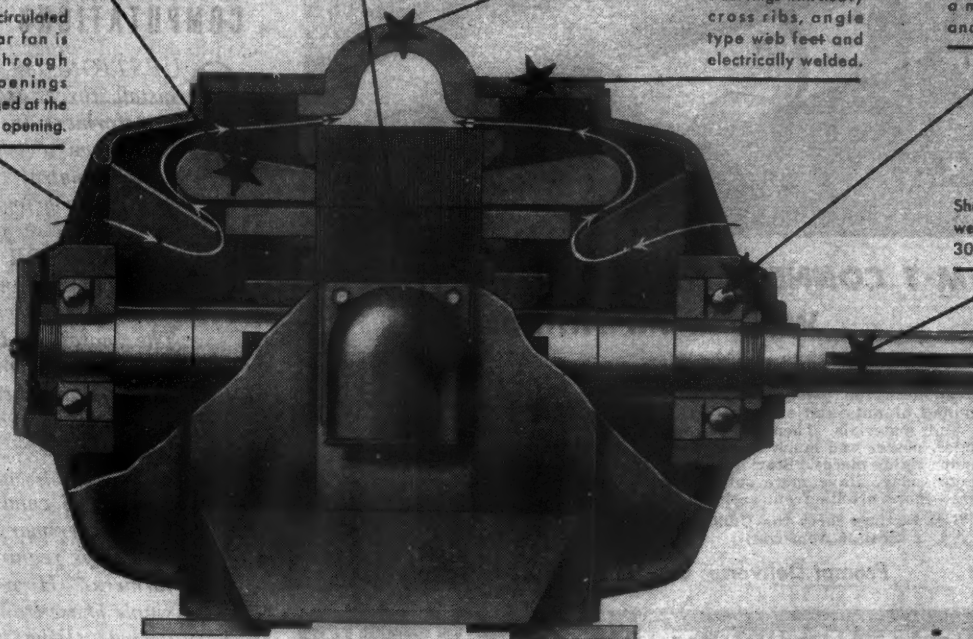


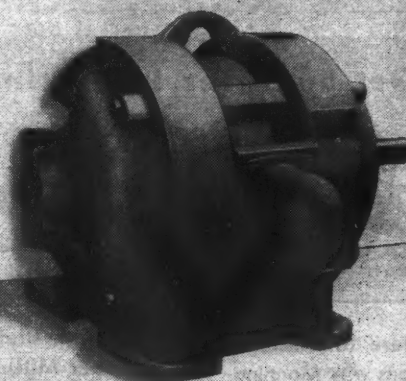
Illustration shows cross section view of Burke Type N 50 h.p. Induction Motor

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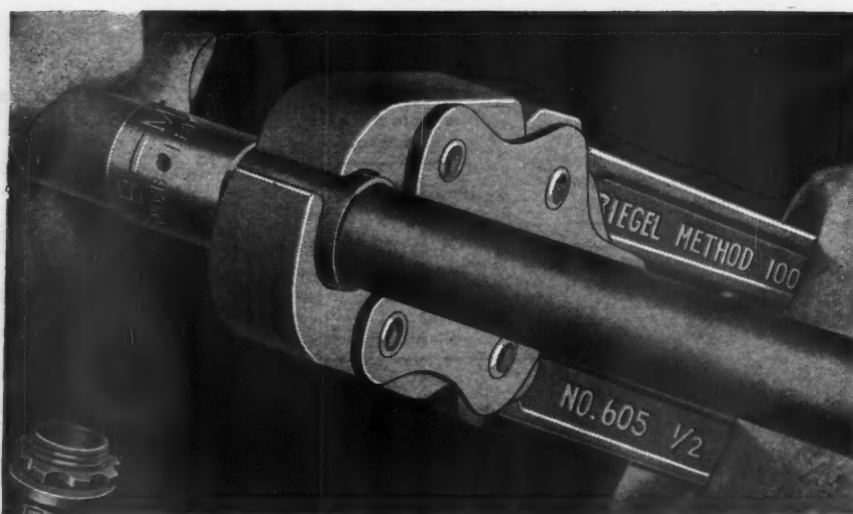
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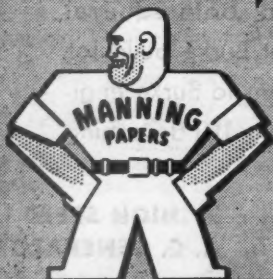
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Then connect two leads of the 20 hp. motor to the line and disconnect the 1/2 hp. motor. This will give you three phase power for running tests. Use the two single phase leads plus the third lead of the three phase 20 hp. motor.—H.S.

TRANSFORMER COMPUTATIONS

QUESTION 149. We intend to install three used single phase transformers in a substation to step down a potential of 7,200 volts to that of 120 volts to neutral. The primary being three wire and the secondary four wire.

The load will consist of three phase induction motors and of the usual incandescent lighting load. The motor load will total 250 kva. at 0.73 power factor; the lighting load being 215 kva. at unity power factor and is planned to be connected between the line wires and the neutral to achieve a balanced condition.

What primary and secondary voltage is required of the transformers? How shall the three single phase transformers be connected? What will be the full load currents in the primary and secondary windings?—P.C.Z.

A. TO QUESTION 149. The question did not state the voltage of the motors to be used but from the requirement that a balanced lighting load from each phase to ground was to be used at 120 volts, then the line voltage would be 1.73 times the phase voltage of 120, or would be 208 volts.

The transformers should be connected delta on the 7200 volt primary side, and wye on the low voltage secondary.

To determine the current in each transformer the procedure is as follows:

Motor load: 250 kva. at 73 percent power factor

$$\text{Motor line current} = \frac{\text{kva.} \times 1000}{1.73 \times E} = \frac{250 \times 1000}{1.73 \times 208}$$

Motor line current = 695 amps.

Lighting load: 215 kva. at 100 percent power factor

$$\text{Lighting current} = \frac{\text{kva.} \times 1000}{1.73 \times E} = \frac{215 \times 1000}{1.73 \times 208}$$

Lighting current = 595 amps.

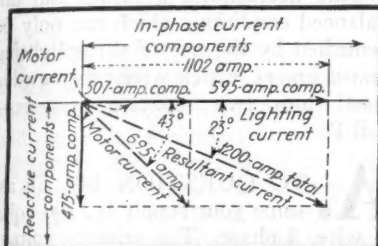
The motor line current and the lighting line current cannot be added numerically since the motor load is at 73 percent power factor which means

that the motor current lags the voltage by an angle whose cosine is .73 namely an angle of 43°. It is necessary to combine the two currents vectorially as follows:

In-phase component of motor current =
Current \times Cosine 43° = 695 \times .73 = 507
amps.

Reactive component of motor current =
Current \times Sine 43° = 695 \times .68 = 475
amps.

The diagram shows how the in-phase component is added to the lighting



current and the sum combined by vectors with the reactive component to give the resultant current.

Total in-phase 507 + 595 = 1102
Reactive component = 475 amps.

The resultant current is found by taking the square root of the sum of the squares of the in-phase and reactive currents. Thus:

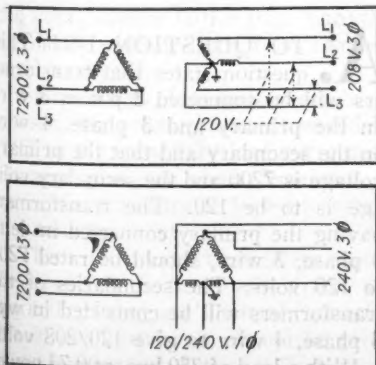
$$\text{Resultant current} = \sqrt{(1102)^2 + (475)^2} = 1200 \text{ amps.}$$

The power factor of the combined load is found from the vector diagram by the ratio of 1102 to 1200 and is 92 percent.

With the transformers connected wye on the secondary each will carry the full line current of 1200 amperes. With the ratio of 60 to 1 this will give a primary current of 20 amperes.—C.E.B.

A. TO QUESTION 149. If the motor load will operate satisfactory on 208 volts 3 phase, I would recommend the use of three 150 kva. transformers, 6900 volt primary and 115 volt secondary (with 7200 v. on the primary the secondary voltage will be 120 v.).

The transformer connection would be delta on the primary and wye on the secondary.



THE ELECTRIC AUTO-LITE COMPANY

TOLEDO, OHIO

Order No. N° 6666

Reg. No.

PURCHASE ORDER

To Superior Graphite Products Company,
Poughkeepsie, New York.

Date

January 3rd, 1920.

Ship Via

F. O. B. Poughkeepsie, N.Y.

Quantity	2½ - 15th Proj.	Description	Price
1,000,000	Motor Brushes - Your Grade No. 2 - As Per our B/P MW-17		\$45.00 Per M

- Shipping Specifications -

Shipments to be made in accordance with schedule, which will be issued to you on the 1st of each month - 200,000 of the above quantity to be delivered to Willys Corporation, Poughkeepsie, New York - 800,000 of the above quantity to be delivered to Willys Corporation, Toledo, Ohio - Plant No. 2.

1. Acknowledgment form attached must be filled in and returned immediately. This order and its acceptance by you are subject to the following conditions:
2. All over-shipments are made on your responsibility; we reserve the right to reject and return, at your expense, material in excess of quantity ordered.
3. The right is reserved to cancel this order if not filled within time specified herein.
4. In consideration of the purchase of the above described articles, Seller agrees to defend, protect and save harmless the Willys Corporation, and its subsidiary or affiliated companies, its or their successors, assigns, customers, and the users of its or their product, against all suits, at law or in equity, and from damages, claims, demands and judgments for actual or alleged infringements of United States or foreign letters patent by reason of the sale or use of the articles hereby purchased.

THE ELECTRIC AUTO-LITE CO.

AFTER 25 YEARS
OUR *First* CUSTOMER
IS *Still* WITH US

1919 1944

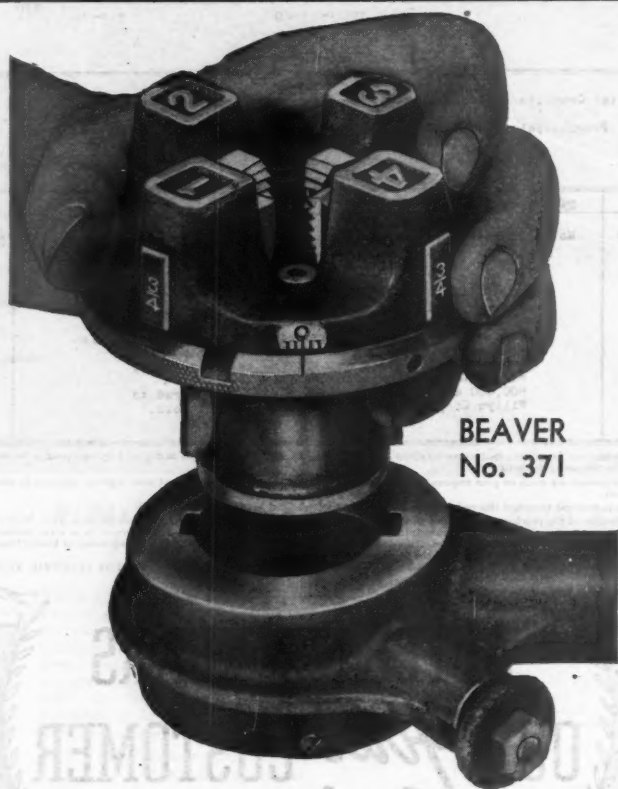
A quarter of a century ago Superior Carbon Products began operations in Poughkeepsie, N. Y. as the Superior Graphite Products Company. Our "first customer" was The Electric Auto-Lite Company of Toledo . . . It is a pleasure to be serving Auto-Lite still. We like to think that perhaps Superior Carbon Brushes have contributed something to the excellence of the Electric Auto-Lite product.

No, we're not going to deliver a lecture on the value of quality in keeping customers on one's list. Certainly we will exert every effort to maintain the quality of Superior Carbon Brushes . . . Nor on the importance of service and deliveries. However, we promise you our utmost in this respect despite the present difficult conditions with which we all have to contend. We will endeavor to make Superior service worthy of a place in every customer's picture.

SUPERIOR CARBON PRODUCTS, INC.
9115 GEORGE AVENUE • CLEVELAND 5, OHIO



SUPERIOR CARBON BRUSHES



**BEAVER
No. 371**

—a new FULLY ADJUSTABLE Threader for pipe up to 3/4" and bolts up to 1". Write for Catalog 44

BEAVER PIPE TOOLS INC.

1042 DEEN AVENUE

WARREN, OHIO

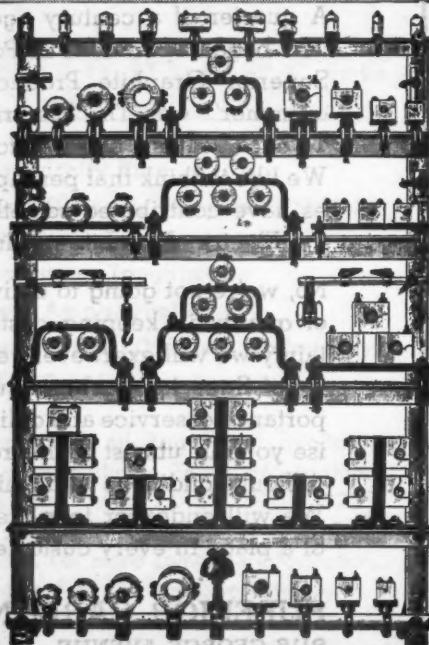
"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

... A COMPLETE line of SUSPENSION DEVICES!

● For safer, more economical suspension of electrical installations specify EFFICIENCY Devices! Designed to fill a long recognized need, EFFICIENCY Suspension Devices are available for attaching wires, cables, conduit, and pipe to all construction forms and surfaces; structural steel, concrete, brick, hollow tile, or wood... without drilling holes! This important advantage makes possible savings not only in time and labor but also in cost of electrical installations.

The illustration at the right shows a number of EFFICIENCY Devices mounted as they would be in actual installations. Note that these fittings clamp solidly to columns, girders, angles, pipe or messengers, safely and securely.

Write today for your copy of EFFICIENCY Catalog 38A... contains complete construction and application data on all EFFICIENCY Devices.



Under balanced and stated load conditions:

The primary line currents will be 34.6 amp. The primary winding current will be 20. amp. The secondary winding and line current will be 1200 amp.

If the 3 phase load requires 220 volts for its satisfactory operation, then I would recommend the use of two 100 kva. and one 300 kva., 6900 volt primary, 115/230 volt secondary.

This necessitates a rather bad unbalanced condition, which can only be remedied by the use of three lighting transformers, which would then evolve itself into two separate systems.—J.B.P.

A. TO QUESTION 149. I assume your supply is 7200 volts, 3 wire, 3 phase. The primary voltage for the transformers should be 7200 volts and the secondary 120 volts. The transformers should be connected delta primary and wye secondary as shown. Each secondary will usually be rated 120/240 volts with four terminals brought out. These should be connected for 120 volts, as shown on manufacturer's connection diagram.

Primary line current will be approximately 34.7 amps. Secondary current will be approximately 1200 amps. The kva. will total 432 or 144 kva. per phase. Three 150 kva. transformers would be used. The three phase secondary voltage will be 208 volts.

The following formula gives combined kva.

$$\text{kva} = \sqrt{[215 + (250 \times .73)]^2 + [250 \times \sqrt{(1 - .73)^2}]^2} = 432 \text{ kva}$$

$$\text{Primary line current} = \frac{432 \times 1000}{1.73 \times 7200} = 34.7 \text{ amps per line}$$

$$\text{Primary winding current} = \frac{34.7}{1.73} = 20 \text{ amps. (delta connected windings)}$$

$$\text{Secondary current} = \frac{432 \times 1000}{3 \times 120} = 1200 \text{ amps. per line and secondary winding (wye connected)}$$

—L.R.B.

A. TO QUESTION 149. This question states that transformers will be connected 3 phase, 3 wire on the primary and 3 phase, 4 wire on the secondary and that the primary voltage is 7200 and the secondary voltage is to be 120. The transformers having the primary connected in delta 3 phase, 3 wire, should be rated 7200 to 120 volts. The secondaries of the transformers will be connected in wye 3 phase, 4 wire to give 120/208 volts. With a load of 250 kva. at 0.73 power

factor and 215 kva. at 1.00 power factor, the total load is 397 kw. The resultant power factor of the two loads is 0.92. Primary full load line current will be 34.6 amps. with a primary winding current of 20 amps. The secondary full load current will be 1200 amps. The full load kva. will be 397 kw. $\div 0.92 = 432$ kva. The size of the transformer would be 150 kva. each or a total bank capacity of 450 kva. to carry this load.—R.E.C.

A. TO QUESTION 149. Use of the 7200/120 volt transformers will be satisfactory as described. This will give a secondary three-phase voltage of 208. However, if the taps of the transformers can be changed to give 125 volts on the secondary side, the load voltage would be 216 between lines. Induction motors wound for 220 volts will give satisfactory service in either case, but at a slightly reduced output.

The transformers would have to be connected delta on the high tension side and wye on the low tension side. It will be necessary to ground the neutral for safety reasons.

Assuming a balanced load, the total current in the secondary windings would be developed as follows:

Phase Voltage (V)
Power Factor (PF)
Reactive Factor (RF) =

$$\sqrt{1 - PF^2}$$

Load kva.

Phase kva = Load kva. $\div 3$

Amp. per phase (A) =

$$1000 \times \text{phase kva.} \div 120$$

In-phase current (I) = A \times PF

Reactive current (i) = A \times RF

$$\text{Total current} = \sqrt{I^2 + i^2}$$

Motors	Lights	Total
120 v.	120 v.	
.73	1.00	
.683	0.0	
250 kva.	215 kva.	
83 $\frac{1}{2}$ kva.	71 $\frac{3}{4}$ kva.	
694 amp.	597 amp.	1104 amp.
507 amp.	597 amp.	474 amp.
474 amp.		1201.5 amp

Thus the secondary current in the transformer winding and in the line is the same, namely 1201.5 amp. since the secondary windings have been assumed wye connected.

Since 60 to 1 transformers were chosen, the primary current would be 1/60 of the secondary load current, or 20 amp. plus say about 3 percent to cover the transformer losses to obtain the actual current value.

Three 150 kva. transformers would be required if the loads given are normal. If they are the total connected loads, the load factor should be given consideration.—L.E.B.

The
**FIRST
STEP**
in

Reconversion

Look

At Your Bearings

It makes little difference whether your machinery and equipment has been on war duty or inactive service. Before you convert to civilian production check up on the bearings. Breakdowns because of bearing failure can be prevented. When replacement is necessary—specify Johnson UNIVERSAL Bronze. It's the best on the market.

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BRONZE

HEADQUARTERS

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TRICO
REG. U. S. PAT. OFF.

"BEST AT THE END OF ANY TEST"

FOR "OUT-IN-FRONT" PERFORMANCE!

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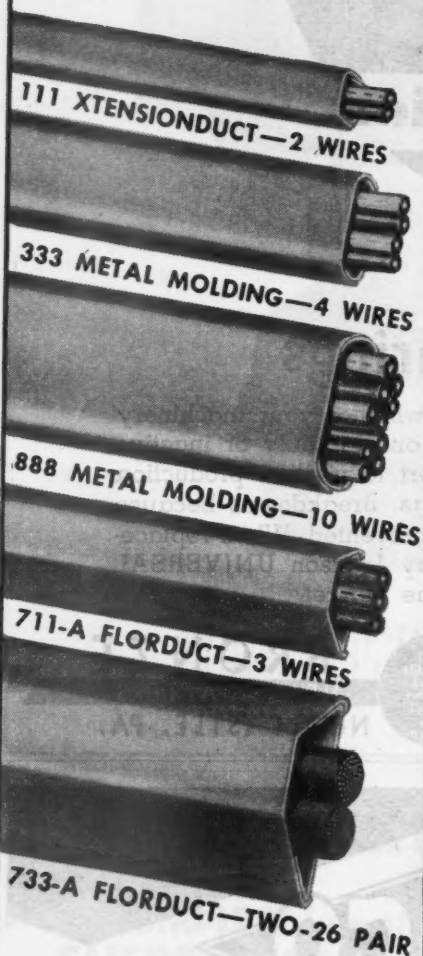
TRICO FUSE MFG. CO.

Milwaukee

Wisconsin

FUSES

*...for Immediate
and Post War Circuits*



THERE is no wiring problem when "Metal Molding" surface raceways are used. The wires are laid in the base, the capping snaps on. It's as simple as that to eliminate fishing and tearing up walls or floors to install additional circuits.

"Metal Molding" is manufactured in three sizes, 111 "Xtensionduct," 333 "Metal Molding" and 888 "Metal Molding." "Florduct" for surface wiring on floors comes in two sizes. 711-A "Florduct" and 733-A "Florduct." All five raceways are interconnectible with each other. These neat appearing surface raceways have a complete line of fittings having two or three different sizes of twistouts to take the various sizes of moldings.

All have a neutral gray finish. For a quick surface wiring job, use "Metal Molding" and "Florduct."

Listed and approved by Underwriters' Laboratories, Inc.

Write for catalog and handbook.

**National Electric
Products Corporation**

Pittsburgh, Pa.

Can you ANSWER these QUESTIONS

QUESTION S6 I want to build a small high frequency induction outfit that would be suitable for melting small quantities of non-ferrous metals and for hardening tools for my shop. Do you have any suggestions for the proper design of such a unit?
—G.R.W.

QUESTION T6 We are going to rewind two overhead trip coils, for a manually operated oil switch. These trip coils were originally operating as series trips, but we wish to operate them from the secondaries of a 400 to 5 amp. current transformer. When we come to calibrate these trips, will it be satisfactory to use a lamp load, and 110 volt a.c.? Will the results be the same as if they were operating from the secondary of a current transformer?—J.A.W.

QUESTION U6 —We operate a motor generator set, the a.c. motor of which is 3 phase, 2200-volt and exciter voltage is about 125 volt d.c. Recently one of our main 2200-volt power transformers blew up and the m-g set stopped. When the spare transformer was cut in and the m-g set started it burned one ring of the two collector rings very badly. It gradually became worse until we had to shut the place down in the middle of the afternoon. The machine was allowed to run till the brushes on this one ring no longer made contact due to being completely burned off. Then the main armature winding started to get pretty hot and finally began to smoke. Not until then were we allowed to stop the machine. What made the armature get hot and smoke as soon as the field quit? The p.f. went to 30 lag. The a.c. amps. went around against the pin and the last figure there is 50 amps.—R.G.S.

QUESTION V6 We have been troubled in our plant the last few months by losing the load on our generators because of loss of excitation on the generator fields. We suspected regulator trouble but to date we have found it impossible to lay the blame on the regulator.

We have a type TA regulator and three exciters connected in parallel to the exciter bus. When the a.c. voltage drops off it is noted that the main contacts of the regulator stand in the open position calling for a decrease in voltage while the voltage has already dropped off and the load is lost. Adjustment of the exciter field rheostats will cause the regulator to start operating and the voltage will come back to normal. This may happen once a week or once a month and it has happened as often as four times in a half hour period. What is the trouble or approach to trouble-shooting this condition?—R.C.M.

PLEASE SEND IN
YOUR ANSWERS BY NOVEMBER 1

FUSIBLE TRIPLOC plugs and receptacles



for Portable Electrical Tools

The use of fusible Triploc plugs on extension circuits will automatically isolate a defective tool or device without interrupting service to other equipment. This protection is especially valuable on production lines using numbers of portable tools. Triploc plugs and receptacles are heavy duty types to withstand hard use. The complete range of types includes fusible plugs, cable connectors, and receptacles in many housing types with conduit fitting bodies in standard styles and sizes. Write for Pylet catalog with complete listings of all types.

THE PYLE-NATIONAL COMPANY

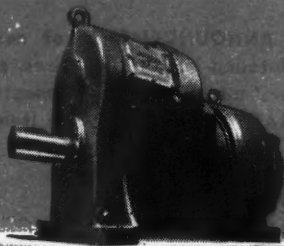
1344 N. Kostner Avenue, Chicago 51, Illinois

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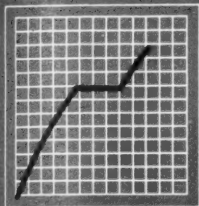
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1/10 TO 100 HORSEPOWER
Five types of gearhead motors
have reduction ratios ranging up
to 432:1.



HIGH EFFICIENCY

More efficient than other
types of slow speed drives
... only 2% power loss in
each stage of reduction, in
parallel shaft type.



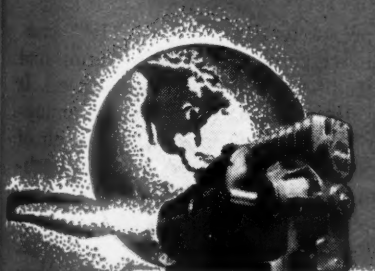
GEARHEAD MOTORS

These are the **good reasons why** gearhead motors met
with such immediate success when The Master Electric Com-
pany originated and pioneered the first line of gearhead
motors, years ago.

These are the **good reasons why** more gearhead mo-
tors in use today carry the Master name than all other
makes ... COMBINED.

These are the **good reasons why** Master Gearhead
Motors will help you save money and still add greatly to
the convenience, compactness and safety of your motor
driven machinery. For best results, use them for either your
plant or your products.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO



PROVEN RELIABILITY

Their durability and stamina have
been proven with millions of hours
of service all over the world.



UNDIVIDED RESPONSIBILITY

The complete Gearhead Motor is
designed and built by one manu-
facturer in one plant.

COMPACT

Integral, compact de-
sign saves space,
saves money, im-
proves appearance.

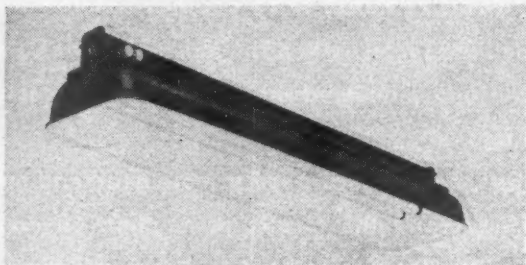


THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of **ELECTRICAL CONTRACTING** you saw the item and they will send full details to you.

EQUIPMENT NEWS

Industrial Fluorescent Fixtures

A new line of "Mitchelite" all-steel industrial fluorescent fixtures is announced. The new units include two and three 40-watt and two 100-watt models, with choice of open-end or closed-end reflectors. The new "Instant-Start" feature is available on the two 40-watt models. Wireway channels and reflectors are constructed of heavy gage steel. Accessories provide for every method of mounting or hanging—individually or in continuous rows. A new type aircraft "Instant-Latch" is provided on all units for quick, easy release of reflectors without the use of tools. They operate on 110-125 volt, 60 cycle a.c. Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago 14, Ill.



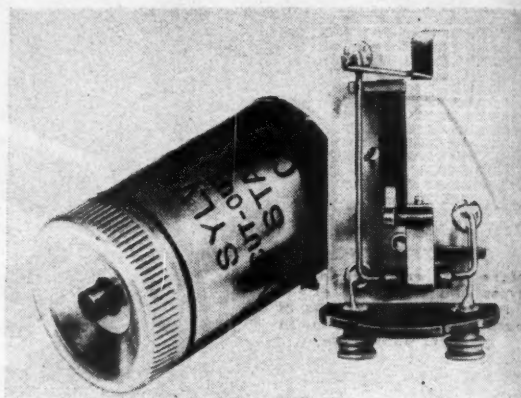
MITCHELL UNIT

Ballast

New two-way lead ballasts for the operation of Mazda F lamps have been announced. They are available in the following ratings: Tulamp 30- and 40-watt, standard cross section; Tulamp 40-watt, high voltage; Tulamp 100-watt; three lamp 40-watt; and Forlamp 100-watt. With leads that can be brought out at either the ends or the bottom of the ballast cases, the new ballasts are interchangeable with both the superseded leads-out-the-end and leads-out-the-bottom ballasts of the same ratings. They are equally applicable to exposed or enclosed mounting on both commercial and industrial fixtures. Provision for center-hole or corner mounting has been retained and fixture design changes are not required for application of the new ballasts. General Electric Co., Schenectady 5, N. Y.



G-E BALLAST



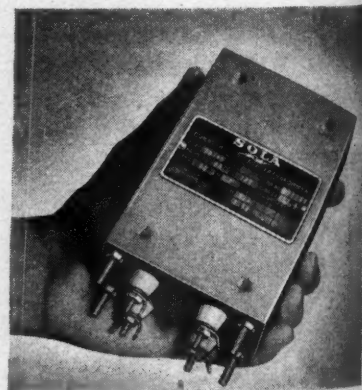
SYLVANIA STARTER

Starter

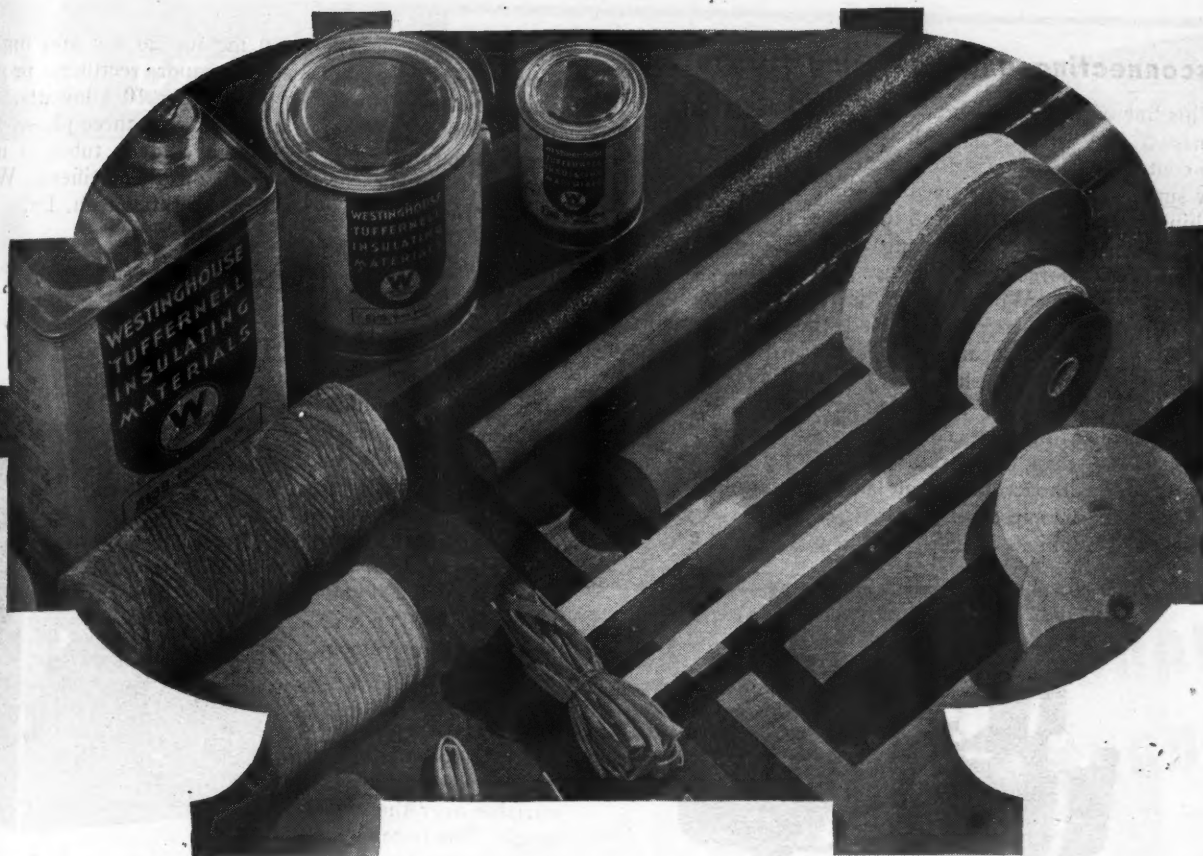
A new push-button type starter called the "COP" (cut-out premium), puts the fluorescent lamp into operation and automatically cuts the circuit in case of lamp failure. It "patrols" a fluorescent lighting installation. It halts annoying flicker or blinking by cutting a deactivated lamp out of the circuit almost immediately. Equipped with a push-button, the COP is ready to give continued service when the fixture is fitted with a replacement lamp. The starter is made one size—the COP-4 for 40-watt fluorescent lamps. Sylvania Electric Products, Inc., 500 Fifth Ave., New York, N. Y.

Voltage Transformer

This constant voltage transformer is a small, compact unit in hermetically sealed case, designed for chassis mounting. Rated at 6.3 volts, 17 VA output, it will maintain that value within plus or minus one percent regardless of line voltage variations as great as plus or minus 12 to 15 percent. It is especially valuable for the stabilization of E-C oscillator circuits. Electronic equipment, in which this transformer is a built-in component of the basic design, does not require filament voltmeters or manual controls. Sola Electric Co., 2525 Clybourn Ave., Chicago 14, Ill.



SOLA TRANSFORMER



Electrical equipment lives no longer than its insulation . . . but how long will different types of insulation live—and why? There's one simple answer . . .

use the insulation proved by FIFTY YEARS OF FIELD TESTS!

Westinghouse is in a natural position to know the answers to these problems. The wide variety of electrical apparatus made by Westinghouse during the past half century has served as a continuous, "first-hand" field test for almost every possible type of insulating material.

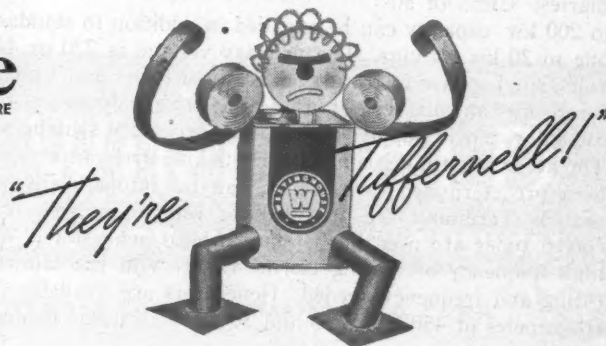
Out of this constant development has grown the complete line of "Tuffernell" Insulating Materials. And with it, an authoritative file of exact application data that is made available to you by Westinghouse Insulation Specialists.

The new "Insulation Sample Book" illustrates this "insulation know-how". It simplifies selection of tapes, fabrics, papers and varnishes by supplying actual samples, complete with dimensions, ratings and helpful application data. Copies are available through your nearest Westinghouse distributor. Ask for B-3322. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-06357



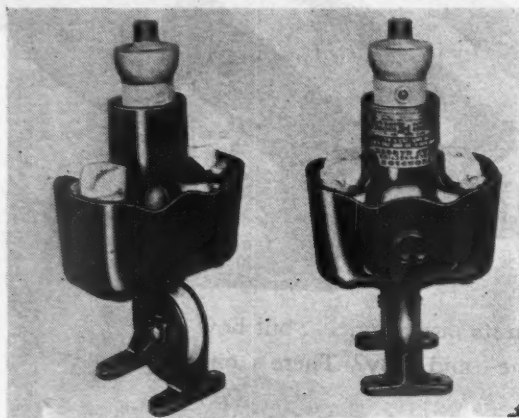
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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INSULATING MATERIALS



Disconnecting and Lowering Hangers

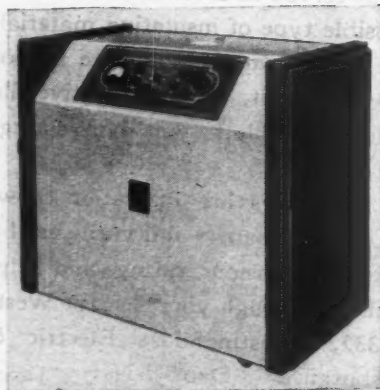
This line of disconnecting and lowering hangers has been improved and simplified. All standard general purpose two-contact type hangers for single two-wire circuits are now supplied with an improved two-hole threaded porcelain bushing and conduit lock nut so that all of these hangers are suitable for either open or conduit wiring. For open wiring, the two-hole porcelain bushing provides an approved entrance method. Where wiring is to be in conduit, the porcelain bushing is removed and the $\frac{1}{2}$ -in. conduit is secured in place by means of the standard $\frac{1}{2}$ -in. lock nut used to secure the bushing in place. Hangers are for complete washing and relamping of indoor or outdoor high-positioned lighting equipment, at ground or floor level, by one man, free from all climbing and electrical hazard, and without the use of ladders, scaffolds, or platforms. The Thompson Electric Co., 1101 Power Ave., Cleveland 14, Ohio.



THOMPSON HANGER

High Frequency Generators

For both induction and dielectric heating loads, a complete line of high frequency generators with ratings of 1, 2, 5, 10 and 20 kw. has been announced. Completely self-contained, the units require only electrical connection to a 60-cycle power supply and have no external cooling or other auxiliaries. Units of 50 to 200 kw. capacity can be supplied in addition to standard one to 20 kw. ratings. The primary voltage is 220 or 440 volts, single phase for ratings of 5 kw. or lower and 3 phase for 10 kw. and higher. Housed in a single cabinet are the oscillator, power supply, blower, and necessary switchgear. The automatic timing control permits load cycle adjustment to a predetermined time, which can be automatically repeated. Terminals are provided for remote control. Air-cooled tubes are used in the standardized generators. The high-frequency oscillating circuit varies with the kilowatt rating and frequency needed. Generators are available for frequencies of 450 kc, 5, 15 and 30 mc for ratings through

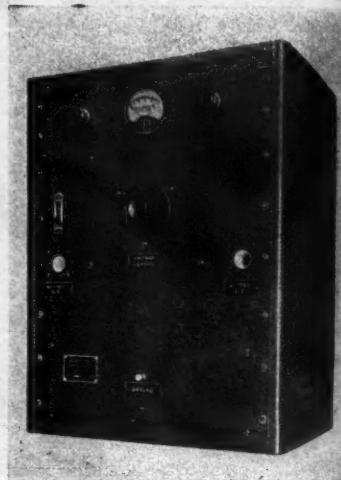


WESTINGHOUSE GENERATOR

10 kw and 450 kc, 2 and 10 mc for 20 kw and higher. Single-phase, full-wave mercury-vapor rectifiers provide the anode current for generators under 10 kilowatts. For capacities of 10 kilowatts and larger, a three-phase, full-wave rectifier, utilizing six mercury-vapor tubes is used. Time-delay switches are standard on all rectifiers. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Voltage Breakdown Tester

Type P-3 voltage breakdown tester is a simple and positive, means of testing voltage breakdown of materials or components. Operating range of instrument is 0 to 10,000 volts d.c. or 0 to 8,000 a.c. A lower range instrument, Type P-1, with sloping panel, has a range of 0 to 4,000 volts d.c. or 0 to 3,000 volts a.c. The voltage is continuously variable over the entire range. The tester operates directly from 110-130 volts, 50/60 cycle a.c. line. A panel light indicates when instrument is "on". Breakdown is indicated by a red signal light, while the built-in meter indicates the direct-reading voltage. Current-limiting resistors safeguard the equipment in the event of a dead short, by limiting the current to approximately 50 milliamperes. To speed up production testing, drawer-switch type fixtures are available. These fixtures have a jig to take given components or materials and when the drawer is closed the voltage is applied. External connections are made by means of an insulated plug inserted in the high potential a.c. or d.c. jack, with the other side grounded. Industrial Instruments, Inc., 17 Pollock Ave., Jersey City, New Jersey.



INDUSTRIAL INSTRUMENT TESTER

Indicating Light

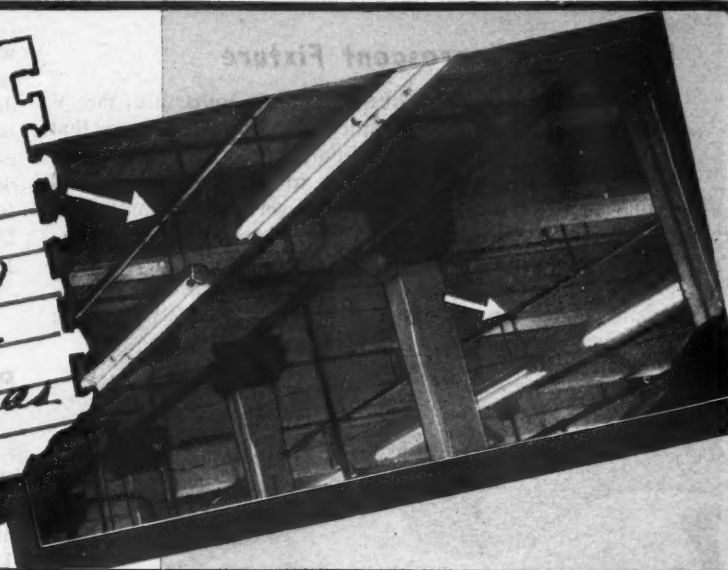
An indicating light for heavy duty service on 120 volts, featuring a small diameter mounting hole and a new type of lens-cap is available. The No. 590 D-E unit mounts in a single $\frac{1}{4}$ -in. diameter hole on panels of extreme thickness. The lens-cap is of the threaded type and contains a heavy walled glass lens, cupped in shape. The tip of the S6 standard 120 volt lamp bulb extends well into the cup of the lens, making easy the servicing of the bulb without the use of tools. The lens design also provides a 180-deg. visibility. The lenses are available in red, green, blue, amber and white with the interior surface sand blasted. Lenses are also available in clear glass. The No. 590 type socket is of the screw candelabra base type for use with the T4 $\frac{1}{2}$ neon glow lamp bulb, as well as with the S6 tungsten bulb. The H. R. Kirkland Co., Morristown, N. J.



INDICATING LIGHT

the problem

*Lighting
modernization
in factory
working areas*



the answer

WIREMOLD

**SIMPLIFIED, FUNCTIONAL
WIRING METHODS**



CAPACITY: Without Receptacles, up to 10 No. 12 R. C. Conductors. With Receptacles, up to 6 No. 12 R. C. Conductors.

● Versatile and widely adaptable Wiremold methods save time and money and assure the efficiency of the finished job. Here, for example, Wiremold No. 2100 Plugmold, spanning overhead beams, has been used as a complete wiring system for industrial fluorescent units. Connections to lighting units are made by simply plugging in to the Plugmold, greatly simplifying maintenance of fixtures.

Similar time and cost saving ideas are constantly being developed by Wiremold engineers and contractors.

Write for latest Industrial Bulletins and Data Sheets.

No. 2127
Plug
Receptacle

No. 2127 S
T-slot
Receptacle

No. 2127 P
Polarized
Receptacle

No. 2127 H
Midget
Twistlock
Receptacle

**WIREMOLD CAN HELP YOU
PRODUCE FOR WAR . . .
WHILE YOU PLAN FOR PEACE!**

KNOW YOUR
WIREMOLD
AND YOU KNOW THE ANSWERS

THE WIREMOLD COMPANY, HARTFORD 10, CONN.



Industrial Fluorescent Fixture

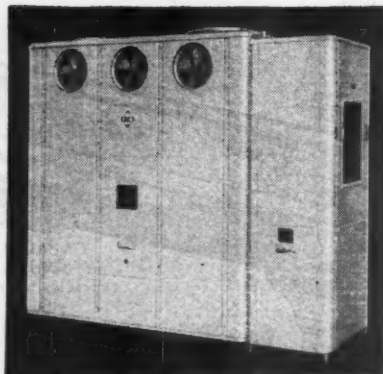
These industrial fluorescent lighting units use the V controlled light reflector. Other features claimed are that light loss is reduced to a minimum, the controlled light reflector directs maximum light to the work plane and actual foot-candle tests. This new series incorporates all basic Smithcraft features, such as a wide variety of mounting methods; new captive-turn positive reflector fastener or release; Supercoat finish, baked or porcelain enamel, simple installation and easy maintenance. A. L. Smith Iron Co., Chelsea, 50, Mass.



FLUORESCENT FIXTURE

Transformer

A newly designed dry type transformer embodying a unique induced cooling system has been announced. This built-in system operates automatically to provide extra cooling when transformers are overloaded. It includes a Z-section baffle which extends from one end of the transformer to the other, channelizing air flow. When temperatures reach the overload level, exhaust fans cut in, forcing cool air vertically through the core structure and horizontally between the coils. Placed on the top and back of the transformer, the fans are protected by screening set flush with the metal casing which encloses all operating mechanisms. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.



ALLIS-CHALMERS TRANSFORMERS

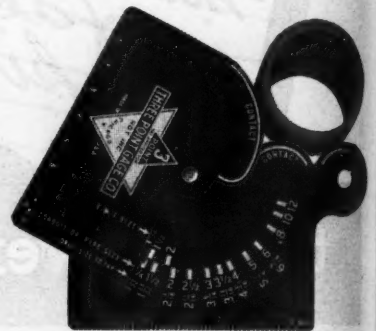
Latex Insulation

Nubun, a new synthetic rubber latex insulation for power, lighting and communication cable. The new insulation is a result of wartime developments in rubber technology and will permit the design of new types of wire and cable with improved electrical and physical characteristics. It is stated that fire alarm, wire and cable police communication systems as well as other highly essential telephonic systems will be more easily replaced and serviced and will have greater resistance to destructive forces which cause circuit troubles with the use of this type of wire. Qualities of Nubun insulation include flexibility, impermeability to

water, laminated construction, and perfect centering of the conductor to produce an insulated wire of maximum conductivity and minimum diameter. The synthetic insulation is said to be exceptionally homogeneous following vulcanization and has high electrical characteristics such as dielectric strength and insulation resistance. It is made from a special modification of Buna S synthetic rubber. United States Rubber Co., Rockefeller Center, New York, N. Y.

Pipe Gage

This new model of the Three-Point Pipe Gage will measure not only all sizes of pipe from $\frac{1}{8}$ in. to 12 in., but all sizes of electrical conduit and metallic tubing. The gage is pocket size and consists of two pivoted steel plates with edges curved at three

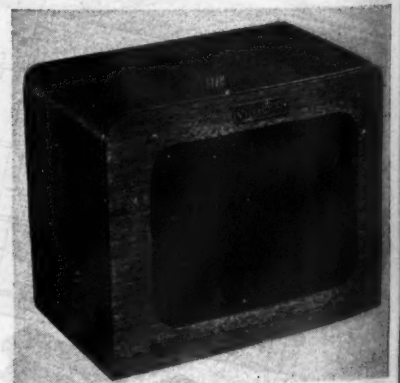


PIPE GAGE

points for contact with the pipe or tubing to be measured, together with scales which automatically register standard sizes of EMT and conduit, and also correct sizes of pipe in terms of inside measurement. A third scale shows the right drill size for tapping. Included is an inch rule and metric rule. It is claimed that covered pipe or tubing can be measured easily with this gage by placing it between the covering joints or in a small opening near a union or other fitting and that the gage can be used in dark places and then carried to the light and read. Three-Point Gage Co., 3821 Broadway, Chicago 13, Ill.

Sound Reproducer

This new baffle type reproducer unit used in voice-paging and industrial music systems provides two-directional reproduction of both voice and music for plant broadcasting. Model HF-6 speaker delivers four to six watts of output power, is recommended for wide-angle coverage of

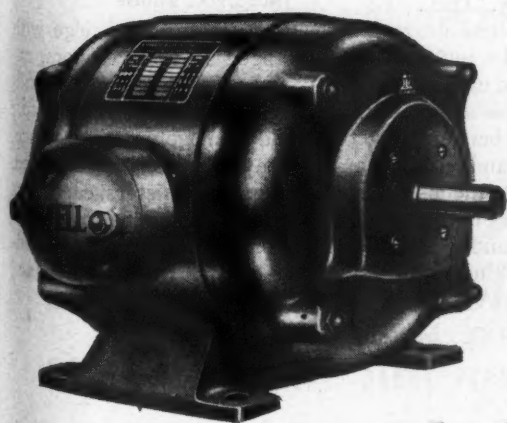


EXECUTONE SPEAKER

medium and low noise level areas. Use of several units, properly spaced, in large production areas, solves the problem of uneven sound distribution. A four-step volume control, with cut-off switch, provides for individual adjustment at each unit. It has a 6-in. permanent magnet speaker with a six ohm voice coil enclosed in the new type acoustical baffle. It is suitable for wall or desk use. Front and back openings have protective covering of rigid mesh faced with harmonizing grille cloth. Executone Corp., 415 Lexington Ave., New York 17, N. Y.



Don't Be Fussin' and Fixin'—Get Horsepower by Howell



The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

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HORSE: I know how you feel about sloppy work.

REPAIR MAN: Here we are at the peak of production, and what happens? Motor failure . . . tear down the machine . . . lose time . . . get behind—all because the motor wasn't built right in the first place.

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REPAIR MAN: That's right! I know it! I'm specifyin' HOWELL for all my new jobs.

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Voltage Regulator



E-M SYNCHROSTAT

This new voltage regulator, known as Synchrostat, is designed for use with a.c. electric generators using direct connected, belted or motor driven exciters, 50 to 60 cycle standards. The regulator consists of a basic, metal-enclosed unit adaptable for regular generator switchboard mounting and for mounting on top of the generator in "packaged" power units. Voltage regulation is plus or minus two percent. The regulator is of the synchronous-contact type; vibrating tungsten contacts of regulator relay operate every half cycle of the a.c. wave, to insert and to remove a resistance in the shunt field circuit of the generator exciter. Regulating action is obtained by the relative time interval the relay contacts are open or closed; the time interval being determined by the voltage from the generator on the regulator relay coil. It employs a new "swing-door" construction where all operating parts are mounted on the back of the hinged door for ease of inspection, with convenient regulator controls on the door front. Electric Machinery Mfg. Co., Minneapolis 13, Minn.

Insulating Varnish

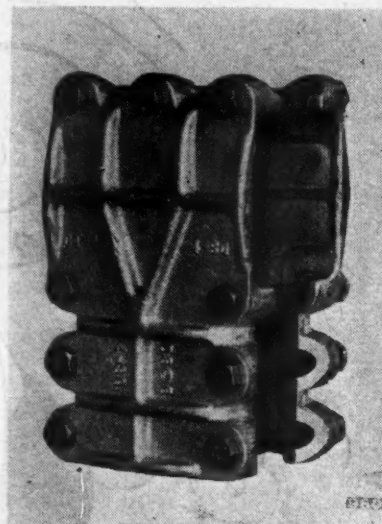
A new process for the application and treatment of insulating varnish to armatures and stators has been announced. It is named the Zanderoll process. Some of the benefits claimed are 50 percent to 90 percent reduction in treating time over previous methods, elimination of varnish drainage immediately on removal from varnish bath, conserving varnish, saving oven clean-up and preventing fire hazards; elimination of necessity for cleaning shafts; penetration and filling of all windings including slot sections; thorough drying throughout, uniformity of distribution permits balancing armatures before varnish treatment, flexibility of stator lead wires maintained. This process does not necessarily require any change in the type of varnish previously used. Sterling Varnish Co., Haysville, Pa.



STERLING INSULATING VARNISH

Tee Connector

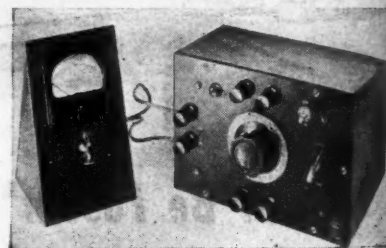
An outstanding feature of this high ampere capacity connector is the strong gripping action secured with two distinct lines of contact at each corner of the tube, giving point by point embeddings. They are cast-to-size with many points of high pressure contact. Delta-Star Electric Co., Chicago 13, Ill.



DELTA-STAR CONNECTOR

Instruments

Type LB direct - indicating comparison bridge is designed for testing of resistors, capacitors or inductors in terms of ohmage, microfarads or henries, respectively. This

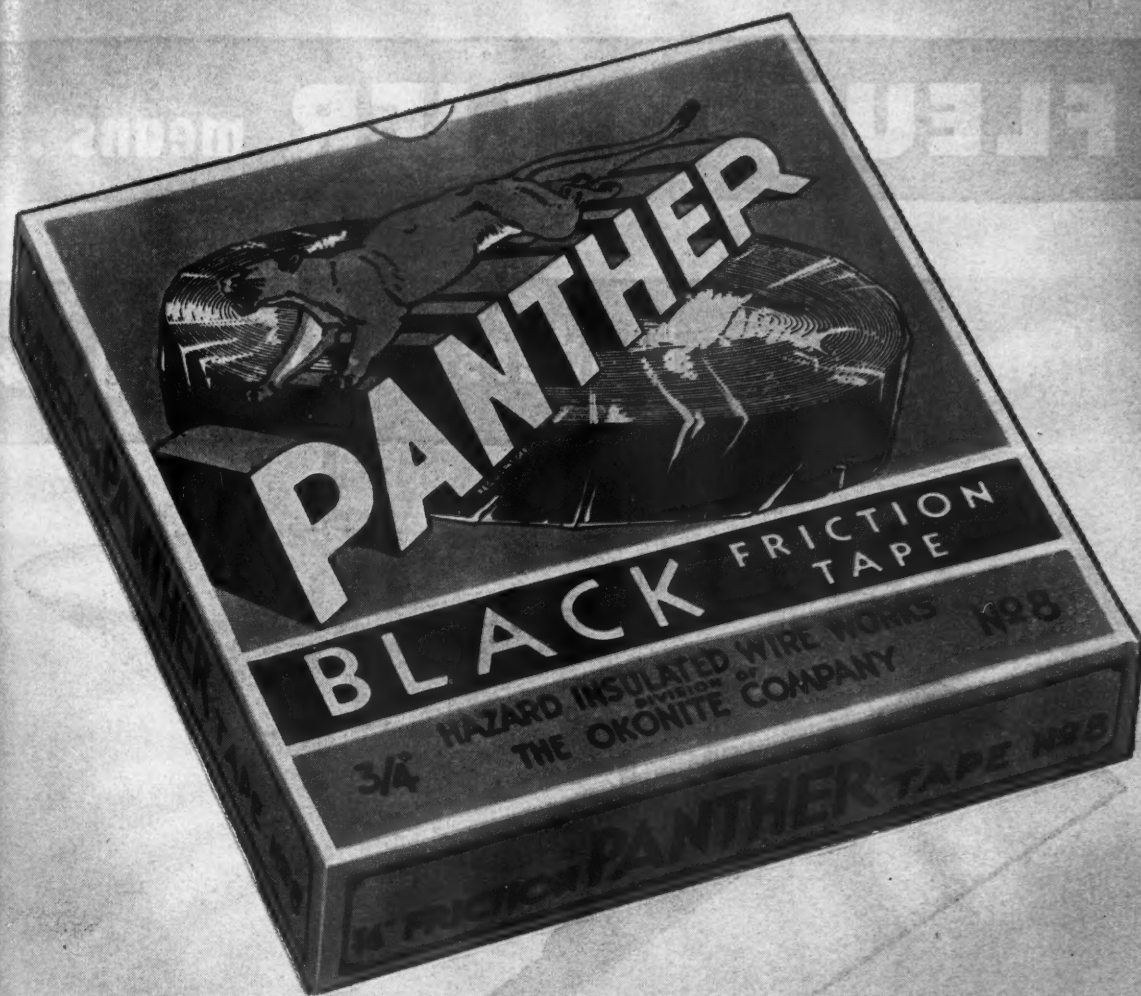


INDUSTRIAL BRIDGE

production-test instrument is an a.c. slidewire bridge with vacuum-tube null indicator arranged so that resistors, capacitors, or inductors can be compared with a similar standard. Ranges are: capacitance, between .0001 and 1.0 mfd.; resistance, between 2000 ohms and 20 megohms; inductance, between 5 and 50,000 henries. The slidewire is uncalibrated. In use, after the instrument is set up, the resistors, capacitors or inductors under test are connected one by one to the "X" terminals and are then rejected or passed by a direct reading of the indicating meter. Industrial Instruments, Inc., 17 Pollock Ave., Jersey City, N. J.

Insulating Tape

A new plastic tape, called "Fibron", is announced. It is used for insulating wires, cables and electrical equipment; for splicing cables, for protecting wires, pipes and equipment exposed to caustic or corrosive fumes, oil, grease, acids, alkalies, or moisture. It is flexible and elastic and manufactured from Vinylite resin. It is heat sealing, flame resistant and high in dielectric and mechanical strength. Irvington Varnish & Insulator Co., Irvington 11, N. J.



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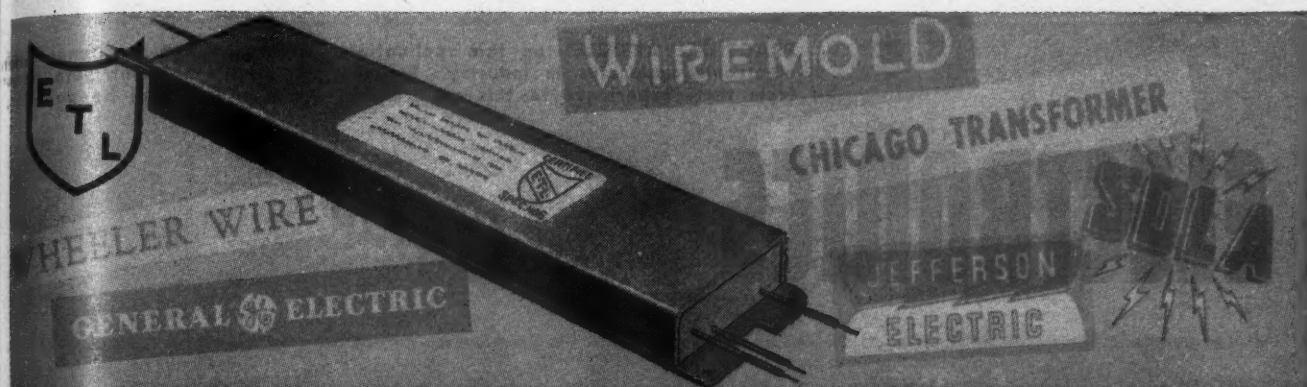
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"

was prepared by Fleur-O-Lier manufacturers and certified by Electrical Testing Laboratories, Inc. NEW YORK, N. Y. 8-41

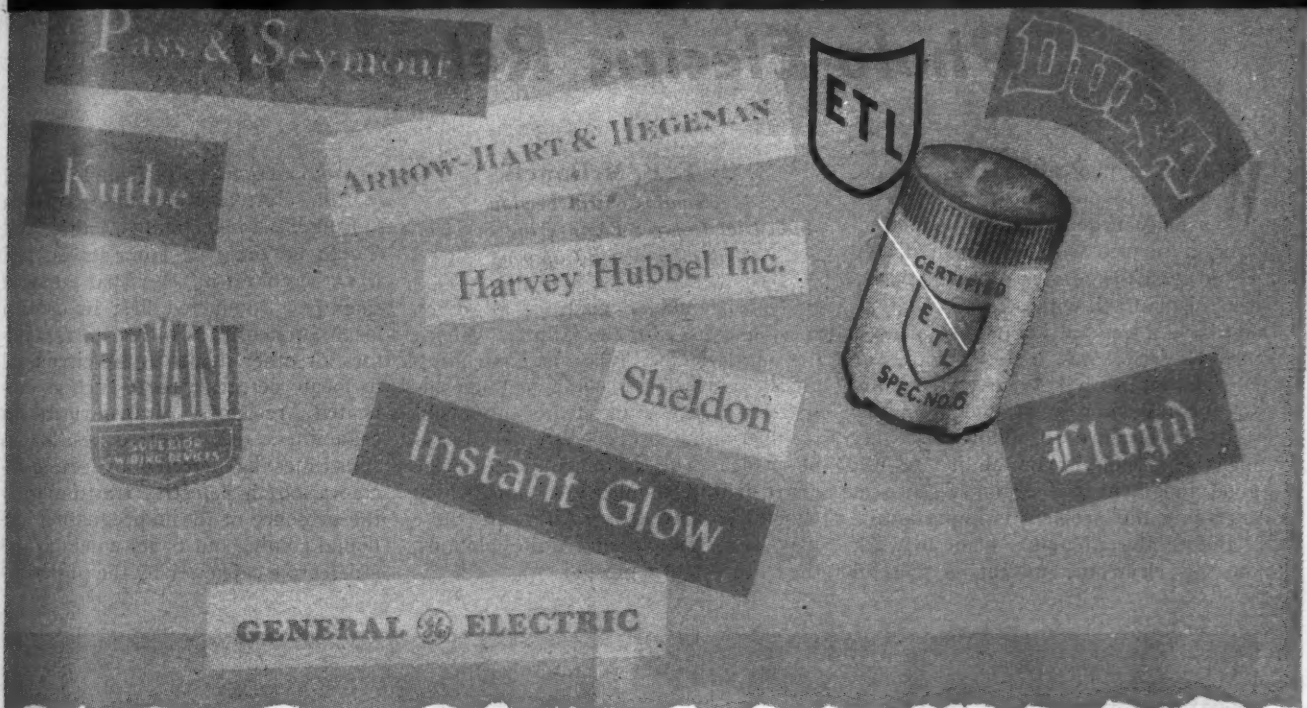
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ELECTRONICS

Installing, Maintaining and Servicing Photo-Electric Relays—II

WHEN a photoelectric installation ceases to operate properly, it is usually urgent that it be placed back in service with minimum delay. To do this, the service man should be well acquainted with the installation and have a general knowledge of how the relay operates. He should also be familiar with service instructions so as to have a good understanding of the procedure to follow in locating the trouble. His ability to use good judgment and common sense in analyzing the problem is important.

Before any attempt is made to work on the electronic circuit, a careful

By E. B. McDowell
*Electronic Control Section
Industrial Control Engineering Service
General Electric Company*

analysis should be made of all other possible causes for the failure. Where the photoelectric relay is controlling auxiliary electrical equipment, an inspection to determine if this equipment is functioning properly should always be made. The accompanying service chart lists a number of items which should be checked. Although these may seem simple and quite obvious, they are often neglected.

After all sources of trouble external to the electronic circuit have been thoroughly investigated, the panel should be removed from its case and work begun on it. A visual inspection should be conducted first in order to locate broken leads to resistors, capacitors, or other points in the circuit, and to locate defective parts such as overheated resistors, transformers, or capacitors. A defective resistor can sometimes be detected by severe discoloration; a defective transformer by the presence of the impregnating compound coming out of its windings; and a defective capacitor by the presence of

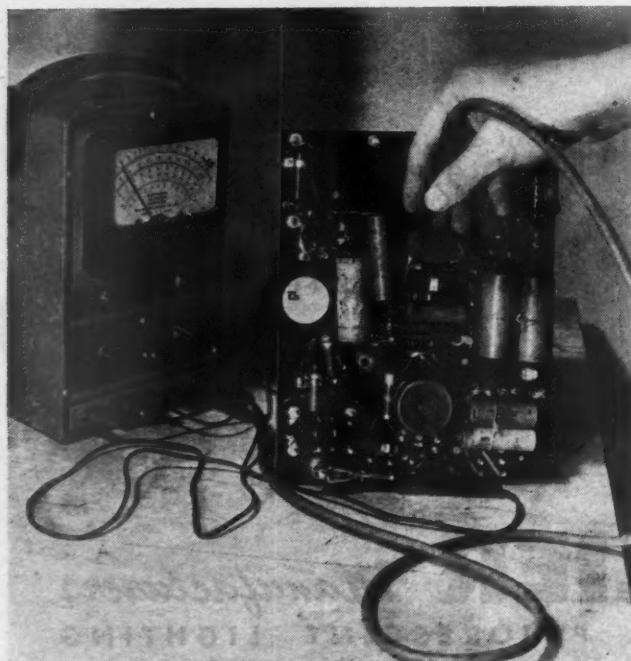


FIG. 1 Checking circuit components of a photoelectric relay. Multimeters used for this purpose are capable of measuring resistance, voltage and current.



FIG. 2 Voltage measurements being made with a vacuum tube voltmeter on a photoelectric relay. This instrument is very useful for servicing electronic equipment.

Testing Springs with a "Picture" Tube



HOW HUNTER PRESSED STEEL COMPANY USES ELECTRONICS IN SPRING-MAKING



As small assembly (mounted on shaft projecting from panel) rotates, the motion of plunger is pictured on cathode-ray tube (upper left). Precise operation of each spring is thus assured. (Photo courtesy Hunter Pressed Steel Co., Lansdale, Pa.)

WHAT is a spring? At the Hunter Pressed Steel Company, it's a piece of "educated" metal—with a personality all its own. For Hunter engineers have made a real science of spring-making.

Since even a small spring may control an important machine or system, its performance must be extremely accurate and dependable.

To help make certain springs better—and to check their results precisely—Hunter engineers have pressed into service the famous RCA "picture" tube. This cathode-ray tube enables them to observe the performance, under actual operating conditions, of a small precision spring in a rotating assembly.

This spring is linked to a small plunger, and is extended and compressed by centrifugal force as the assembly rotates. In test, the assembly is rotated at prede-

termined speeds in a magnetic field. The motion of the plunger and the changes produced are flashed on the screen of the RCA Cathode-ray oscillograph, as shown in the photograph above. Thus, the cathode-ray tube "pictures" the spring action quickly and accurately while the assembly is in operation.

This is just one example of how many jobs can be done better, cheaper, and faster the electronic way.

The cathode-ray tube has many applications in industry. It can be used to make instantaneous measurements of electrical circuit performance; to make continuous observations of a wide range of processes; to compare dimensions, colors, speeds; to

measure time intervals as short as a millionth of a second; in fact it can observe or measure any quantity that can be converted to voltage or current.

If you have a problem in any of these classes, it may well be that standard RCA cathode-ray tubes can be adapted to your requirements. In any event, why not write, stating your problem in detail? Our RCA Tube application engineers may be able to help you. Address: RADIO CORPORATION OF AMERICA, Commercial Engineering Section, Dept. 62-16C, Harrison, New Jersey.

Remember, the Magic Brain of all electronic equipment is a Tube...and the fountain-head of modern Tube development is RCA.



RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

62-6331-14

wax or liquid on the outside of the container. When a defective circuit element is discovered in this manner, further analysis should be made to determine if the trouble was caused by the failure of another circuit element. For instance, a short-circuited capacitor or potentiometer could result in the overheating and consequent failure of a resistor or transformer with which it is associated. Each circuit failure presents a different problem and therefore must be analyzed separately.

If the visual inspection does not provide a solution to the trouble, then a check on the various circuit elements by means of an ohmmeter to locate such faults as short-circuited capacitors and open resistors or contactor coils may be necessary. When measuring a resistor, be sure that there are no resistors at other locations in the circuit in parallel with the one being measured.



FIG. 3. The plate current of a tube about to be measured by means of a tube adapter and a milliammeter.

This would give an incorrect reading.

If data are available on the transformer voltages and the d.c. potentials at various points in the circuit, the trouble may be soon located by checking these voltages with a suitable instrument. For measuring the d.c. voltages, a high-resistance voltmeter having a resistance of 5000 to 20,000 ohms per volt should always be used. In some cases, it is even necessary to use a vacuum tube voltmeter having an internal resistance of 10 to 15 megohms. The type of voltmeter which should be used can be determined readily from the value of resistance across which the measurement is to be taken. To provide accurate readings, the voltmeter resistance should be at least 10 and preferably 20 times the resistance of the resistor across which the instrument is placed. For example, to measure the voltage across a 100,000-ohm resistor, the total resistance

SERVICE CHART FOR PHOTOELECTRIC RELAYS

TROUBLE	CAUSE	REMEDY
A. Upon the completion of the initial installation, the relay or contactor cannot be made to respond to light changes.	1. Incorrect Wiring	1. Inspect all connections and correct any errors.
	2. Incorrect adjustment.	2. Adjust equipment in accordance with manufacturer's instruction.
	3. Line voltage is not within specified limits.	3. Provide proper line voltage to the equipment. If voltage varies over wide limits, use a constant voltage transformer. If voltage is consistently high or low, an auto-transformer can be used to correct the voltage.
	4. Fuses Blown.	4. Be sure to check all connections before replacing fuses. Do not use fuses larger than necessary to protect the equipment.
	5. Damaged relays or contactors. Contact tips may have been burnt or welded due to improper connections. Relay or contactor may have been damaged during transportation or installation.	5. Repair or replace relay or contactor.
	6. Tubes placed in wrong sockets.	6. Locate tubes in accordance with socket markings.
	7. Defective tubes.	7. Test tubes and replace defective ones. If tester is not available, replace tubes one at a time with a spare.
	8. Lamp in light source not lighted.	8. (a) Replace lamp if burned out. (b) Investigate the connections to the light source and its transformer, and repair if necessary.
	9. Too low voltage on the lamp. Voltage as measured at lamp (not at transformer) should be within the limits specified by the manufacturer. Usually this is between 4.5 and 5.2 volts.	9. (a) Use larger size wire to light source, if excessive voltage drop is occurring between transformer and light source. (b) Check light source transformer and replace, if defective.
	10. Light source not properly focused and aligned with respect to the phototube unit.	10. Make necessary adjustments.
	11. Light level at phototube too low.	11. (a) Increase lamp voltage. (b) Decrease distance between light source and relay. (c) Use light source with larger diameter lens. (d) Place lens in front of phototube, or if lens is already being used, substitute one of larger diameter.
	12. Light other than that from the source is reaching the phototube. This may be daylight, light from room fixtures, or reflected light from mirrors or polished surfaces.	12. (a) Remove interfering light or provide suitable shades. (b) Relocate phototube unit.
	13. Too low insulation resistance in phototube circuit. This includes the socket, cable, and terminal board connections.	13. Replace cable, sockets, or other defective parts. The insulation resistance between all high impedance points and ground, with the phototube removed and cable disconnected from panel, should exceed 500 megohms.

Continued on page 152

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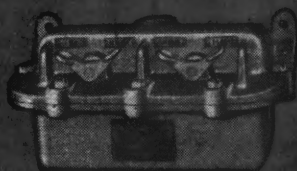
Special Service, Foot-Operated Push Button for Magnetic Starters and Controllers.



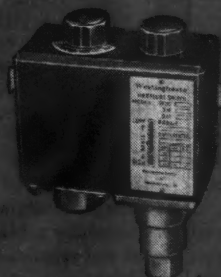
A-C or D-C Heavy-Duty Push Button, Air Break Station for Class I, Group D and Class II, Groups E, F, G, Hazardous Locations.



A-C or D-C Heavy-Duty Push Button, Water and Dust-Tight Station, Suitable for Outdoor Service.



A-C or D-C Heavy-Duty Push Button, Oil-Immersed for Class I, Group D and Class II, Groups E, F, G, Hazardous Locations.

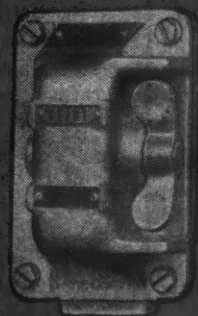
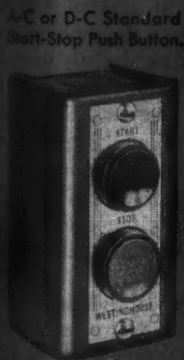


Pressure and Vacuum Switch for Water Pumps, Air Compressors and General Duty.

A-C or D-C Heavy-Duty Push Button, Surface-Mounted Station with Indicating Lamp.



Chain-Operated Float Switch for A-C or D-C Pilot Circuits.



A-C or D-C Standard Push Button, Dust and Water-Tight Station.



Reversing and Nonreversing General-Purpose Master Switch for A-C or D-C Magnetic Controller.



Rod-Operated Float Switch for A-C or D-C Pilot Circuits.

TROUBLE	CAUSE	REMEDY
Continued		
A. Upon the completion of the initial installation, the relay or contactor cannot be made to respond to light changes.	14. Phototube cable too long.	14. Reduce the cable length if it exceeds that recommended by the manufacturer. Relays in which an a-c supply is applied to the phototube are usually provided with about six feet of cable. More light required if length is increased.
B. Same as A, except failure occurred after relay had operated satisfactorily for a period of time.	1. Check items A-2, 3, 4, 7, 8, 9, 12, 13. 2. Contacts of relay or contactor may have welded, or they may have reached the end of their operating life. 3. Broken or loose connections, between relay panel and phototube holder, or auxiliary circuits. 4. Vibration of loose mounting has caused misalignment of light source, phototube unit, or light, reflecting surfaces. 5. Excessive accumulation of dirt oil film, or other foreign matter on the lens, or other surfaces which transmit or reflect light. 6. Defect in electronic circuit, such as: (a) Broken or loose connections (b) Shorted or open capacitors (c) Open resistors or potentiometers (d) Shorted or open transformer windings (e) Shorted or open relay or contactor coil.	1. As indicated for the respective causes. 2. Replace contacts. If contacts weld frequently, the current inrush to the load is too great, either the load must be reduced or an auxiliary contactor installed. 3. Repair faulty connections. 4. Place equipment in proper alignment. 5. Clean the surfaces and inspect at regular intervals. 6. Locate fault and make necessary repairs.
C. Erratic operation of photoelectric unit, that is, contactor operates at random intervals without any change made to the light beam.	1. Variations in lamp intensity caused by worn lamp contacts, or loose connections to lamp socket. 2. During the interval when light from the source is cut off, light from another source may shine on the phototube momentarily. 3. Variation in line voltage outside of the limits specified for the equipment. 4. Transient voltages induced into the phototube circuit by the power circuit.	1. Replace lamp. Tighten any loose connections. 2. (a) Remove the interfering source or provide suitable shades. (b) Relocate phototube unit. 3. Either provide a better regulated source or use a constant voltage transformer. 4. Phototube cable must be shielded and separated from all power wiring.
D. Contactor or relay chatters either continuously or during the interval while it is being energized or de-energized.	1. Shielding of phototube cable is not properly connected. 2. Photoelectric equipment not grounded. 3. Grounded side of a-c power supply not connected to proper terminal as specified. 4. Defective electronic circuit. Possibly an open capacitor in the rectifier filter circuit, or across the coil of the relay or contactor.	1. Shield must be connected to phototube holder and to the proper point on the panel. In most photoelectric installations the shield is at ground potential. 2. Ground the relay enclosure and phototube holder. 3. On certain photoelectric relays which do not use a transformer in the circuit, the grounded side of the a-c supply must be connected to the proper terminal. 4. Locate defective part and replace.

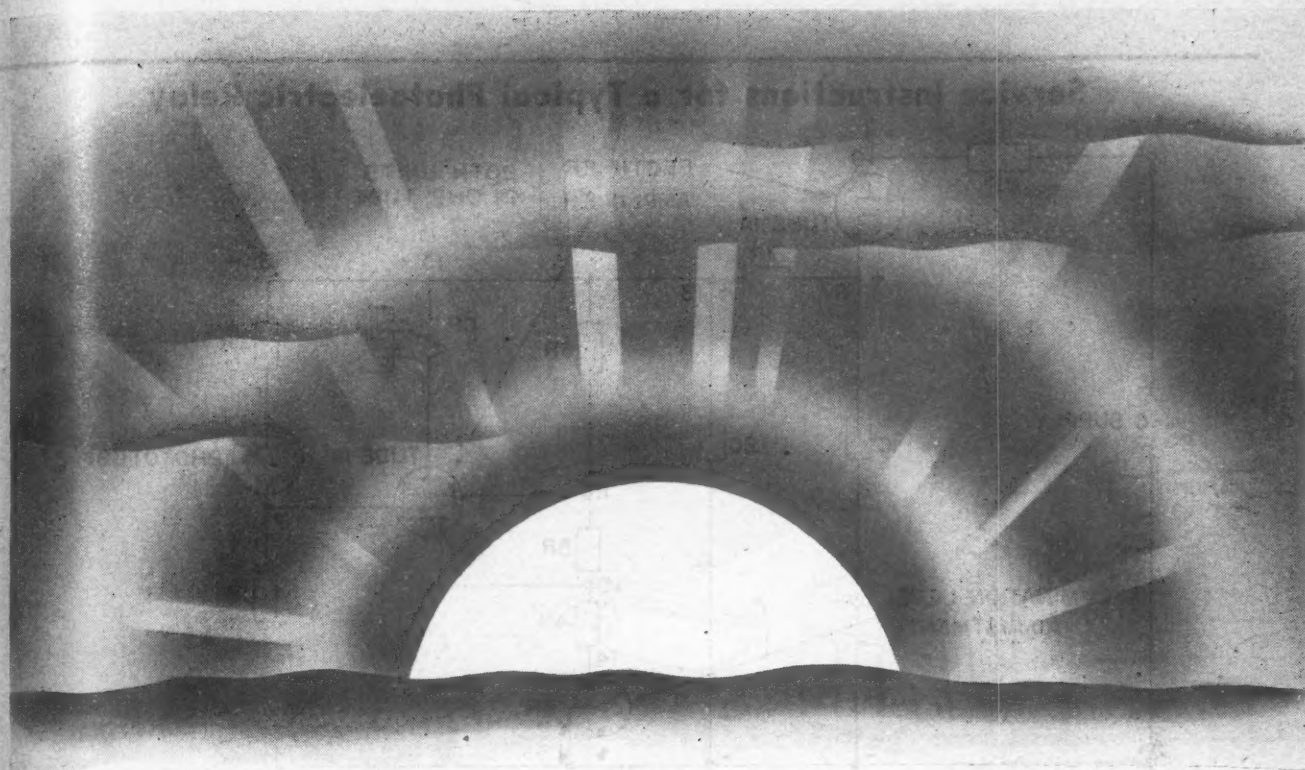


FIG. 4 Measuring voltage supply to a photoelectric relay. This voltage should be maintained within plus or minus 5 percent of the rating on the nameplate.

of the voltmeter should be at least one million ohms.

The present demand for smaller and less expensive devices has made it necessary to add the electrolytic capacitor to the list of components. The life of this type of capacitor cannot be expected to be practically indefinite as is sometimes assumed to be for other types of capacitors. Although the average electrolytic capacitor will give satisfactory service for many years, it is still possible to find occasional failures after about a year of service. In electronic circuits, failures due to over-voltage are practically eliminated because the capacitors are normally operated well below their rating. The operating temperature of the electrolytic is one factor which affects its life. Since temperatures above 65 C are quite detrimental, it is advisable to mount the relay in as cool a location as possible. Where the ambient temperature runs 40 C or slightly more continuously, it will be helpful to drill a few holes in the case for ventilation if the unventilated type is being used for the particular application.

When failure does occur it usually results in the capacitance dropping to zero instead of short circuiting, as is commonly experienced in radio receivers. In many cases the effect of an "open" electrolytic is to permit unfiltered d.c. to pass through the contactor and cause it to "chatter".



WHAT'S ON THE POST-WAR HORIZON for Electric Motor Control?

Are any revolutionary changes being contemplated for electric motor control equipment?

If so, will these changes and improvements have a bearing on plans you may be making right now for future purchases?

It occurred to us that you might like these questions answered by an expert before making final decisions concerning the motor control details of your post-war production facilities.

The expert we have in mind is the Monitor Field Engineer stationed in your locality. You'll find that he can keep you fully and completely informed on all new developments—will interpret the meaning of these developments in terms of your own particular requirements. Why not get to know your Monitor Field Engineer now. You may find that he is a profitable acquaintance to have.

The Monitor Controller Company

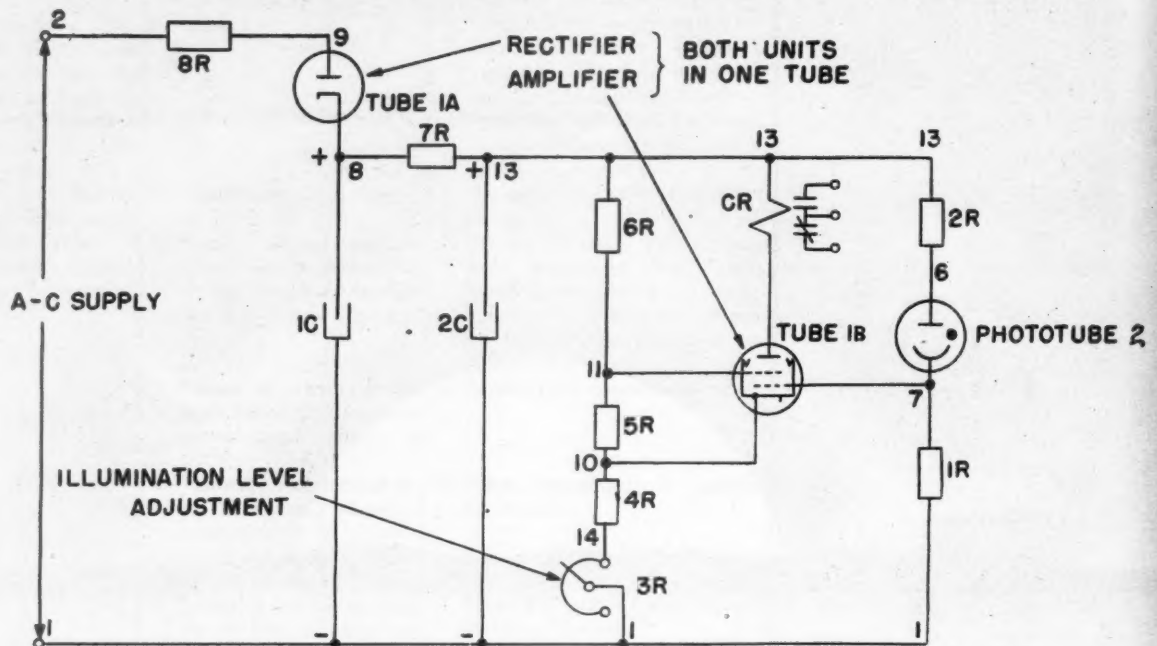
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Service Instructions for a Typical Photoelectric Relay



The installation to which these service instructions apply consists of a photoelectric relay, a light source, and a magnetic counter. The units are installed in conjunction with a conveyor line to count packages as they pass through the light beam. An elementary diagram of this relay is shown above. In this circuit the a-c line voltage is rectified by the tube 1A and the resulting d-c voltage, after being filtered by capacitors 1C and 2C and resistor 7R, appears between points 1 and 13. The phototube 2 and the two resistors 1R and 2R are connected in series across this d-c supply. When light strikes the phototube, current flows through this circuit and the voltage developed across 1R raises the grid potential of the amplifier 1B. The increase in plate current of 1B, which accompanies this grid change, causes the relay to pick up.

The potentiometer 3R, by control of the cathode to grid potential, provides a means of adjusting the plate current so that the relay is always dropped out during minimum light conditions. Thus the relay picks up when the light is increased, and drops out when the light is decreased.

The resistors 3R, 4R, 5R, and 6R form a voltage divider across the d-c supply to provide the proper potentials to the amplifier tube.

The procedure for servicing the equipment in case the counter fails to register the packages is as follows:

1. Investigate all common sources of trouble as outlined in the service chart. These include failure of the line voltage, lamp burn-out, broken or loose connections, failure of the tubes, or improper adjustment of the equipment.
2. Observe the operation of the telephone relay.
 - a. If light on the phototube does not cause the relay to pick up, the trouble may be due to an improper setting of the light level adjustment, a tube failure, or a fault in the electronic circuit.
 - b. Cutting all light from the phototube should cause the relay to drop out. If it responds correctly and yet the counter does not operate, the trouble is either in the relay contacts or the counter and its associated electrical circuit. Failure of the relay to drop out indicates either improper setting of the light level adjustment, a tube failure, or a fault in the electronic circuit.
3. If the preceding analysis indicates circuit trouble, remove the panel from its enclosure and make a visual inspection of the circuit to locate any obvious faults, such as broken or loose connections, or overheated resistors. Connections to the phototube socket in the external holder should also be examined.

Next apply line voltage and check the circuit voltages. With an instrument having at least 5000 ohms per volt, measure the d-c

voltages between points 1 and 10, 1 and 11, 1 and 13, and compare them with the values specified by the manufacturer. If all of the voltages are appreciably under the correct values, either the emission of the rectifier element is low and the tube must be replaced, or capacitor 1C or 2C is defective.

A high voltage between 1 and 13 would indicate an open circuit in the voltage divider 3R, 4R, 5R, and 6R. Poor contact between the slider of the potentiometer 3R and its resistance element would be one point to investigate for an open circuit.

By rotating the adjustment 3R over its complete range with the phototube dark, the plate current should change sufficiently to pick up and drop out the relay. If this does not occur, the trouble may be due to any of the following causes:

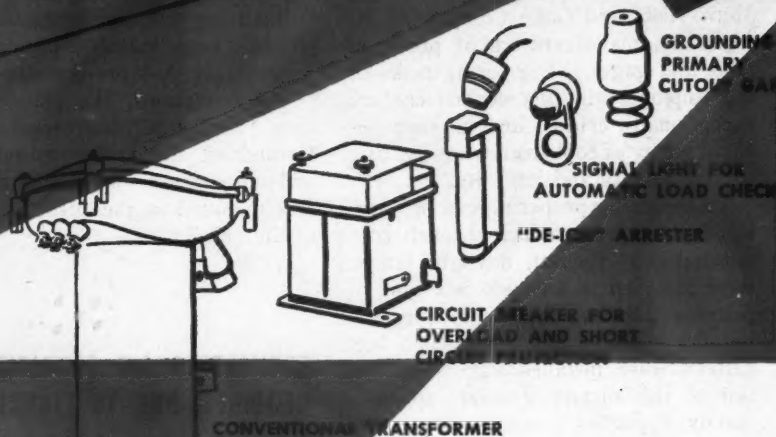
- a. A defective amplifier tube or phototube may cause the relay to remain either picked up or dropped out. Operation of the circuit should be tried with new tubes.
- b. The relay coil may be open-circuited.
- c. If low leakage resistance (500 megohms or less) develops between points 6 and 7 of the phototube circuit, the relay will not drop out. Failure of this kind may occur where the equipment is being operated under conditions of high humidity or where metallic dust particles may enter the relay case or phototube holder. This leakage condition will be associated with either the phototube socket or the cable to the phototube. The socket can be tested by removing its connections and measuring the resistance between the two terminals to which the phototube connections are normally made. If the resistance is low a new socket should be installed. If the trouble is due to the accumulation of metallic dust, there is a possibility that a thorough cleaning may eliminate the leakage condition.

A test can readily be made to determine if the extended phototube holder and its cable are at fault, by disconnecting the cable from the panel and observing the operation of the relay as the adjustment 3R is rotated. If the relay picks up and drops out with the cable disconnected and remains picked up with the cable connected, the trouble is associated with the phototube holder or the cable. Leakage can often be caused by deterioration of the cable or by poor splices.

The above example presents an outline of the service procedure for a typical installation. Since the service problem will vary with the type of relay and its application, general service information cannot cover in detail all the possible conditions which might be encountered. Therefore, the service man should be thoroughly familiar with the equipment on which he is working, and be capable of making his own analysis of the problems not covered by the general information.

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MODERN LIGHTING

LIGHTING FOR PRECISION GRINDING

Surface grinding is a precision operation at the newly built plant of the Metro Tool and Gage Company, Chicago, Ill., manufacturers of precision tools and gages. The seeing tasks of the employees in this department are exceptionally critical and as such demand plenty of cool shadowless lighting of high quality and intensity.

To secure the proper type of lighting, RLM fluorescent reflectors, each containing two, 40-watt, daylight lamps, were installed in an open box type of pattern. The two fixtures forming the parallel sides of the three-sided box pattern were installed parallel to the bed of the surface grinder, approximately 30 inches from the center line of the bed. The fixture forming the third side of the pattern was mounted over the aisle between the grinders and the line of workbenches. All units are conduit suspended from the ceiling at a 7-ft., 3-in. mounting height.

Light meter readings, after several hundred hours of operation, indicated an intensity of from 55 to 60 foot-candles at the reciprocating bed and magnetic chucks of the grinders and an average intensity of 50 foot-candles

on the work benches across the aisle from the grinders. By painting the walls and ceilings of the department a light color, the efficiency of the lighting system is materially increased.

Realizing that sight, one of the employee's most valuable physical attributes, is an A-1 prerequisite for precision operations, the plant management has used fluorescent lighting throughout the entire manufacturing and office areas—with concealed troffers mounted in the suspended ceiling of the offices.

ESTIMATING AIR CONDITIONING REQUIRED DUE TO LIGHTING

We all know that light sources, in addition to providing light for vision, also produce varying amounts of radiant energy. As outlined in the Westinghouse Lighting Handbook, the incandescent lamp produces relatively large quantities of this radiant energy—per unit of light, about four times as much—as compared to the fluorescent lamp.

Such radiant energy is absorbed by the walls, ceilings, furnishings and oc-

cupants of an interior in the form of heat. This condition may or may not be desirable depending upon the other temperature conditions in the room. The comparative energy distribution of fluorescent and filament lamps is presented in the following table:

Comparative Energy Distribution				
Lamp Type	Light	Conducted Heat	Radiated Heat	Conducted Heat
40-watt Mazda F lamp	18.5%	13.5%	27.0%	41.0%
100-watt filament lamp	8.0%	5.0%	67.0%	20.0%

Radiant energy must be kept to a minimum in air conditioned rooms for optimum comfort of the occupants. Because of its high efficiency and relatively low radiant energy production, the fluorescent lamp is favored for use in such installations.

In cases of this type, when *estimating air conditioning costs*, one must remember that the work which the cooling system must perform is based on the total wattage of the lamps and auxiliaries installed and not on the radiant energy. It follows that the same amount of cooling is required per watt of fluorescent as for one watt of incandescent lighting.

The following factors and formulas can be used for estimating the amount of air conditioning required due to lighting installations:

1 Watt = 3.415 B.t.u. (British thermal unit)

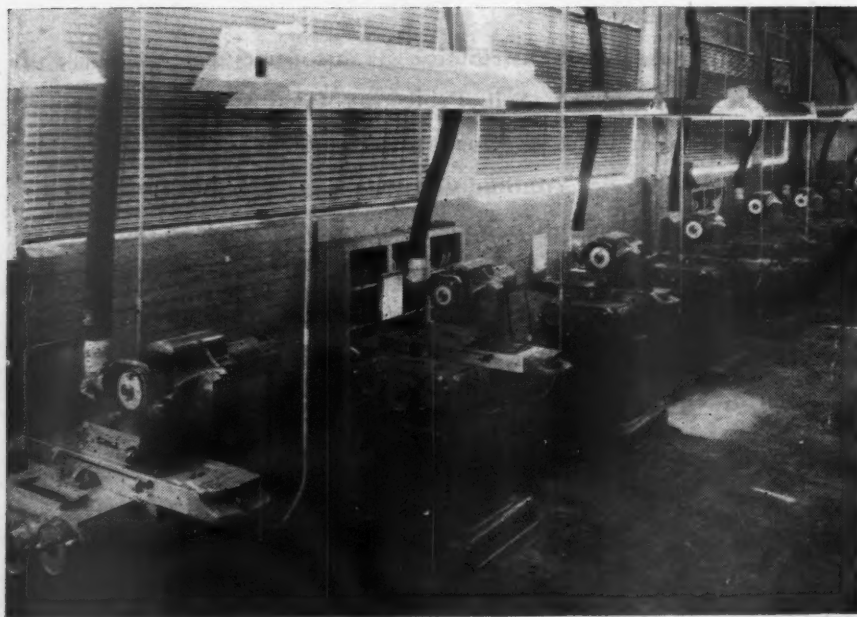
1 Kilowatt = 3415 B.t.u.

Formulas:

- (a) B.t.u. per hour generated by the lighting = lighting Kilowatts \times 3415
- (b) Tons of Air Conditioning =
$$\frac{\text{B.t.u. per hour}}{12,000}$$

The higher efficiency of the fluorescent lamp is a distinct advantage since equal illumination levels can be obtained with less wattage of fluorescent lighting—hence less cooling load is required.

[Continued on page 197]



PRECISION LIGHTING for precision grinding. Surface grinders in this tool and gage plant are bathed with 55 to 60 foot-candles of evenly distributed shadowless fluorescent light—reducing eye fatigue of operators and increasing quality and quantity of production.

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Direct Ceiling or
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THE PARKWAY

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The CORONADO is a shielded type unit with ribbed diffuse glass side panels. Reflecting surface and louvers are finished in baked SUPER-WHITE enamel. Steel enclosure frame in baked lustre aluminum enamel. The entire enclosure is held in place by spring suspension tension clips and service chains—easily installed and removed in a few seconds... Both types are complete with all necessary fittings, ready for quick installation.

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IN THE NEWS

Inspectors Discuss '45 Code

In preparation for the coming revision of the National Electrical Code, sectional conferences of the International Association of Electrical Inspectors review new proposals and recommendations.

NORTHWESTERN SECTION MEETING, IAEI.

Reported by W. A. Cyr

With revisions recommended in 18 of the National Electrical Code articles, generally to tighten, clarify and return to former standards, the Northwestern Section, International Assn. of Electrical Inspectors started the 1944 series of annual meetings at Olympia, Wash., August 21-23, with registration of over 110 men. J. Hyde Stayner, meter superintendent, Utah Power & Light Co., Salt Lake City, president, conducted the meeting; C. M. Kirsop, electrical inspector, Olympia, was general chairman. J. D. Lynett, supervising chief inspector, New York City, president of IAEI, keynoted with an address urging a return to prewar standards. He pointed to the fire losses after the last war as an index of what may be expected from the relaxation of standards and workmanship.

Articles 210 and 220, Branch Circuits and Feeders, were approved in substance as recommended changed by the article committees. Article 500, Hazardous Locations, brought the recommendation made at last year's meeting that the article treat only two classifications, Class 1 flammable gases and vapors, and Class 2, combustible dust. Many changes were proposed in several of the sections. The meeting also approved in substance the new Article 725, Remote Control, Low Energy Power and Signal Circuits.

At one code breakfast session, at which inspectors' problems are aired, concern was general over whether the so-called electricians of the war production period, given brief training before assignment to shipyard or aircraft plant jobs, would not be adequately trained to do regular electrical work. It was generally felt that a real apprenticeship, training and experience was needed to turn out journeymen electricians.

Postwar committees of IAEI reported at this meeting. F. H. Murphy, Portland General Electric Co., recommended an all-industry promotion of adequate wiring

after the war as a means to correct the inadequate wiring. W. R. Volheye, state inspector for Oregon, urged greater acceptance of the Code to achieve more uniformity. I. B. Sturges, electrical inspector, Portland, recommended that the name "sales control ordinances" be changed to "electric equipment ordinances" in order to eliminate a negative reaction. He told of the national committee's plan to prepare a booklet as a manual for the preparation, passage and administration of such ordinances. There was no recommendation from the reinspection committee except that something should be done.

Recommending national adoption of an electrical safety week such as that declared in Washington last May, Capt. Stephen E. Sanislo, Seattle Fire Dept., chairman of the public relations committee emphasized its value in bringing the subject into public awareness. Governor Arthur B. Langlie of Washington, in welcoming the delegates, declared meetings such as these highly essential and important in the preparation for the post-war period. Other speakers heard were H. G. Ufer, western superintendent, Underwriters Laboratories, Inc., Los Angeles; Fred P. Oliver, Union Insulating Co., Parkersburg, W. Va.; J. J. Siddall, H. H. Robertson Co., Pittsburgh.

Harry Hilpert, electrical inspector, state of Washington, Seattle, was elected president of the section; W. H. Gaffney, electrical inspector, Tacoma, secretary-treasurer, succeeding Fred Weber, retired.

SOUTHWESTERN SECTION MEETING, IAEI.

Reported by W. A. Cyr

Reiterating a proposal that had originated out of the experience in house wiring in the far West, despite complete bypassing of it by the national Article 210 committee, the Southwestern Section International Assn. of Electrical Inspectors, at its Santa Cruz annual meeting, Aug. 28-30, endorsed almost unanimously a

proposal to the Electrical Committee as follows:

1. That all receptacles be installed on exclusively receptacle circuits. That such branch circuit conductors be not smaller than No. 12 and be protected by overcurrent protection not greater than 20 amp.

2. That all branch circuits in residential occupancies have conductors not smaller than No. 12. Lighting circuits, however, shall be fused at 15 amp.

3. That non-combustible insulation be required on all cords used to supply portable appliances, equipment and devices.

4. That such cords be not smaller than No. 16.

This proposal came at the end of a spirited discussion of the entire proposed revised Article 210, most of which was accepted. Proposed change to Article 430 and other articles relating to motor wiring were turned over bodily to the Electrical Committee for action. These changes were made to reconcile the National Electrical Code and the State Safety Orders of California which have been at variance for years.

In an important paper, R. R. Cowles, electrical engineer, Pacific Gas and Electric Co. urged that three-phase motors be required to have overcurrent protection which would open all three phase wires because so many such motors are burned out when lines have trouble and lose a phase distorting the voltage on the other phases, often not opening the overcurrent protection.

Code breakfast session discussions often indicate the matters which bother inspectors the most. By that token spray booth lighting was the chief headache; and what to do about high-voltage tubular lighting for indoor illumination seemed to be the other. In some instances inspectors felt that the rigid requirements in respect to spray booth illumination were too severe and unnecessary. Other experiences with explosions and fires brought the advice of caution. On the floor of the meeting it was recommended that a technical committee be given the job of studying and revising code requirements.

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The Southwestern Section had surprisingly complete attendance, about 100, nearly all of whom were active inspectors. N. J. Siggins, electrical inspector, San Francisco department, president, conducted meetings with snap. Harold L. Gerber, chief inspector, San Francisco, secretary-treasurer of the section, proved an expert in code details by his handling of 34 pages of suggested code changes coming from the article committees of the section. Except for short business sessions the entire meeting was devoted to code discussion. There were only two papers, aside from the individualized address of J. D. Lynett, supervising chief inspector, New York City, IAEI president. These were the paper by Cowles, referred to, and a short address by J. J. Siddall, H. H. Robertson Co. Victor Tousley, IAEI secretary, proposed an adaptation of the standard two-prong cord connector and receptacle to provide a third prong and receptacle for grounding to the neutral or grounding conductor inside the outlet box, using a three-wire cord. The idea was endorsed by a resolution.

To succeed Siggins as president E. E. Larson, city electrical inspector, Riverside, was elected. Vice presidents elected were M. J. Sandles, Oakland, and H. G. Ufer, Los Angeles. Gerber was re-elected.

WESTERN SECTION MEETING, IAEI

Reported by August Eckel

Postwar electrical inspection problems posed by wartime conditions and restrictions were on the minds of more than 400 members and guests in attendance at the Fortieth Annual Meeting and Wartime Conference of the Western Section International Association of Electrical Inspectors held at Indianapolis' Hotel Claypool, Sept. 11-13. Centered around this theme was a comprehensive program of postwar reports, feature speakers and healthy down-to-earth discussions of inspector problems.

Education was a dominant word in a number of the talks and reports. Western Section president R. D. MacDaniels, Indianapolis, in his address, reiterated the concern over wartime wiring and, foreseeing a tremendous task of electrical inspection, urged the Section to immediately undertake a comprehensive educational program; to stimulate organization of electrical inspection departments in localities where none exist and to adequately staff present departments. Arthur H. Welkin, Fort Wayne, Ind., expanded this theme and urged inspectors to take advantage of the IAEI News-Bulletin, trade publications, public libraries, plant visits, etc., plus a good dose of psychology to equip themselves for their job of interpreting and applying electrical safety. "Should we have classes for electrical inspectors?" was a question posed by E. J. Brown, president, International Brotherhood of Electrical Workers, who, after briefly outlining the I.B.E.W. electronics course at Marquette University,

emphasized the urgent need of keeping abreast of the times.

Cooperation was another theme dominating many talks and committee reports. Urging a strong international organization equipped to do the tremendous postwar educational and technical task to protect life and property, International president James D. Lynett, New York, went on to advocate a sound and comprehensive electrical code with proper revisions to incorporate latest developments and to eliminate the "stripping" characteristics of the emergency measures forced by wartime conditions. Revealing that numerous, long-outmoded building codes are still in use throughout the country, J. J. Siddall, H. H. Robertson Co., Pittsburgh, advocated the active cooperation of the various inspection departments in cities and municipalities and urged the IAEI to promote a solution to the apparent lackadaisical method of specifying electrical materials.

Postwar Committee reports reviewed the gigantic task ahead of the electrical inspector and presented recommendations for organization of specific programs. Acknowledging the vast number of inadequate electrical installations throughout the country, J. Hyde Stayner, Salt Lake City; and R. B. Kellogg, Chicago, presented the recommendations of the Committee on Inadequate Installations. These embraced: a joint all-industry promotional and educational program to promote a high standard of electrical adequacy; promotion of electrical inspection as an advisory service to remove the

"policing" stigma; certification of electrical plans prior to issuance of building permits; and increasing N.E.C. minimum standards toward an adequacy basis.

Now, if ever, is the time to organize and promote electrical re-inspection, urged V. C. Moulton, Denver, Colo., as he presented his postwar committee report. One inspector's recommendation was presented for thorough study. It suggested that a State law be passed requiring that deeds to all property transfers be accompanied by inspection certificates showing that all utility services (gas, electric, water, sanitary, steam, etc.) conform to Code standards. The City of Los Angeles, Calif., having organized a comprehensive re-inspection program during the depression, is all set to promote this again during the postwar period, he revealed. The answer to the re-inspection problem lies in education of the public, inspector, and state and local governments, he added. Reinspection coupled with sales control will aid in eliminating present hazardous electrical installations, he concluded.

Reviewing the development of industrial infra-red heating, R. C. Loughhead, chairman, Technical Sub-Committee on Infra-red Lamp Industrial Heating Equipment, Electrical Committee, NFPA, revealed that under the proposed new rules industrial infra-red heating equipment will be under Article 422 as an industrial appliance; that the rules will permit 300 to 660 watts on medium base lamps subject to U. L. approval, over 150 v. to ground, and series lamp connections.



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Elimination of most of the substitute materials and methods (emergency measures) in the postwar era was the consensus of opinion indicated by a survey conducted by the IAEI postwar committee on the investigation of this subject. A chart talk presented by R. B. Shepard, New York, covering the survey results showed this attitude prevalent both among those who had and had no experience with the materials.

By the end of this year, building wire with reclaimed rubber insulation will disappear and be replaced with Buna S synthetic insulation (type RW wire with Buna S insulation is now classified with label service) reported A. R. Small, president, Underwriters Laboratories, Inc., who revealed that the materials situation now permits the use of pre-war standard metals in a number of products. Immediately following his address, Mr. Small was presented with a gold plated IAEI plaque by James D. Lynett, in commemoration of the 50th Anniversary of the Underwriters' Laboratories.

An illustrated talk "Electronics at Work" by A. J. Germain, Westinghouse Electric & Mfg. Co., and a sound film "Materials at War" presented by Howard H. Weber, U. S. Rubber Company, rounded out the feature program.

Opening the Inspector's Problems session, V. H. Tousley, secretary-treasurer, IAEI, reviewed the stop dates for suggested revisions for the new Code.

Among the resolutions approved by the conference were: (1) that members hold regular Code Schools for the electrical safety education of returning servicemen who become wiremen; and (2) the adoption of a standardized receptacle and plug designed to accommodate either the present 2-prong parallel blade or a 3-prong grounded plug, and that the Electrical Committee, NFPA be requested to consider a modification of the National Electrical Code to require such a standardized receptacle on all new installations.

Western Section officers elected at the business session were: President, Roy Burgess, Chicago, Ill.; first vice-president, George C. Monroe, Springfield, Mo.; second vice-president, Arthur H. Welkin, Fort Wayne, Ind.; secretary-treasurer, F. H. Moore, Indianapolis, Indiana. W. J. Alcock, Chicago, was the new member elected to the Executive Committee.

LIGHTING ENGINEERS LOOK AHEAD

A broad picture of the future of the lighting field was presented to more than 700 members and guests of the 37th Annual Meeting and Technical Conference of the Illuminating Engineering Society held at the Edgewater Beach Hotel, Chicago, Sept. 14-15. All phases of the lighting industry—residential, commercial, institutional and industrial—were reviewed with particular emphasis on post-war technical developments and promotional plans.

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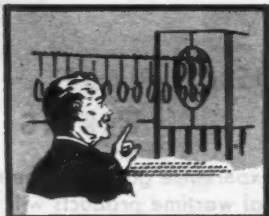
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papers on the influence of lighting on the posture and health of school children, was presented by Dr. Darell B. Harmon, Director of the Division of Educational Services, Texas State Department of Health and Executive Director of the Texas Inter-professional Commission on Child Development. While exploring the relationship between light and child health, Dr. Harmon examined some 160,000 school children in 4,000 Texas class-rooms and discovered that: 71 percent had nutritional deficiencies; 30 percent posture defects; 59 percent refractive eye deficiencies; 39 percent non-refractive eye deficiencies; 61 percent chronic infections; 20 percent chronic fatigue; 59 percent needed visual attention; and 92 percent needed dental attention. Of 10,000 school buildings in the state less than one half were wired for artificial light; less than 20 percent have enough funds to satisfy any lighting code.

Pursuing his research, he discovered most of the deficiencies in children seated behind an imaginary line 40 degrees to the plane of the windows, starting at the front window and extending diagonally to the rear of the room. After setting up a test room with seats in this section next to the windows rearranged perpendicular to the imaginary line—those ahead of this line remaining parallel to the windows—and the side and rear blackboards removed, he found improvements of 65 percent in refractive eye defects; 92 percent in non-refractive eye defects; 47.8 percent in nutritional defects, and 43 percent in chronic infections. These results plus movies taken in actual class-rooms showing children involuntarily ducking to shield their eyes from window glare or turning to moderate reflected glare on books, prove his contention that improper light sets up physiological stresses in the body which, if permitted to continue, lead to physical deficiencies regarding the normal growth and development of children.

Brightness was the subject of two technical papers. Presenting the first report of the IES Committee on Standards of Quality and Quantity for Interior Illumination, Dr. Matthew Luckiesh, chairman, revealed that to attain best seeing conditions the brightness-ratios between the visual task and its immediate surroundings and between a light-source, or luminous portion of a luminaire to its background should be unity; to attain good seeing conditions, these ratios should not be greater than three.

W. G. Darley and A. K. Gaetjens, General Electric Company performed a series of tests on the subject of high brightness in the field of view of industrial fluorescent continuous trough fixtures (resulting from inadequate shielding angles) which produced disturbing brightness ratios, reduced eye comfort and sometimes reduced visibility. Using a vertical center louvre between the lamps of a two-lamp industrial fixture they found that crosswise brightness could be materially reduced. Indications were that greater brightness protection could be provided industrial workers by shielding of at least 35 degrees for crosswise viewing (present standard is 17 degrees) without materially affect-



How Four Leading Manufacturers are Helping Save Precious Paper for Uncle Sam

A BIG OIL COMPANY—"In 1943 we reduced the number of issues of our house publication from 12 to 6. Our employe house organ was reduced in size as were our dealer window displays, and all promotional material was kept to the smallest possible size."

A BIG DRUG COMPANY—"The weight of our corrugated board was reduced to the minimum necessary for protection to our goods in transit. The weight of board used on some items was cut almost in half. We increased the pack per shipping case on many items where doubling of the quantity in each case would not result in an unwieldy or hard-to-lift unit. Nests, partitions and liners were dropped right and left. Package insets have been dropped except on one item."

A BIG CHEMICAL COMPANY—"Where 100-pound basic-weight paper had been specified as desirable, the

lightest practical weight is now used. All pieces and forms are carefully checked for reduction to next standard smaller size, excessive margins, and number of pages or parts. The Company has adopted single typewriter spacing where practical, typing on both sides of the sheets, pruning lists, and all such miscellaneous practices. Wastepaper at our plants and offices is not burned but baled to reach paper mills for conversion."

ANOTHER BIG DRUG COMPANY—"In 1943 we stopped issuing an almanac. We had been sending out around twenty million. We also discontinued our small booklets, the edition of which was some thirty to thirty-five millions. For 1944 we kept the ban on booklets and also cut out the printing of twenty million calendars."

These quotations are from reports to the A. N. A. Paper Committee

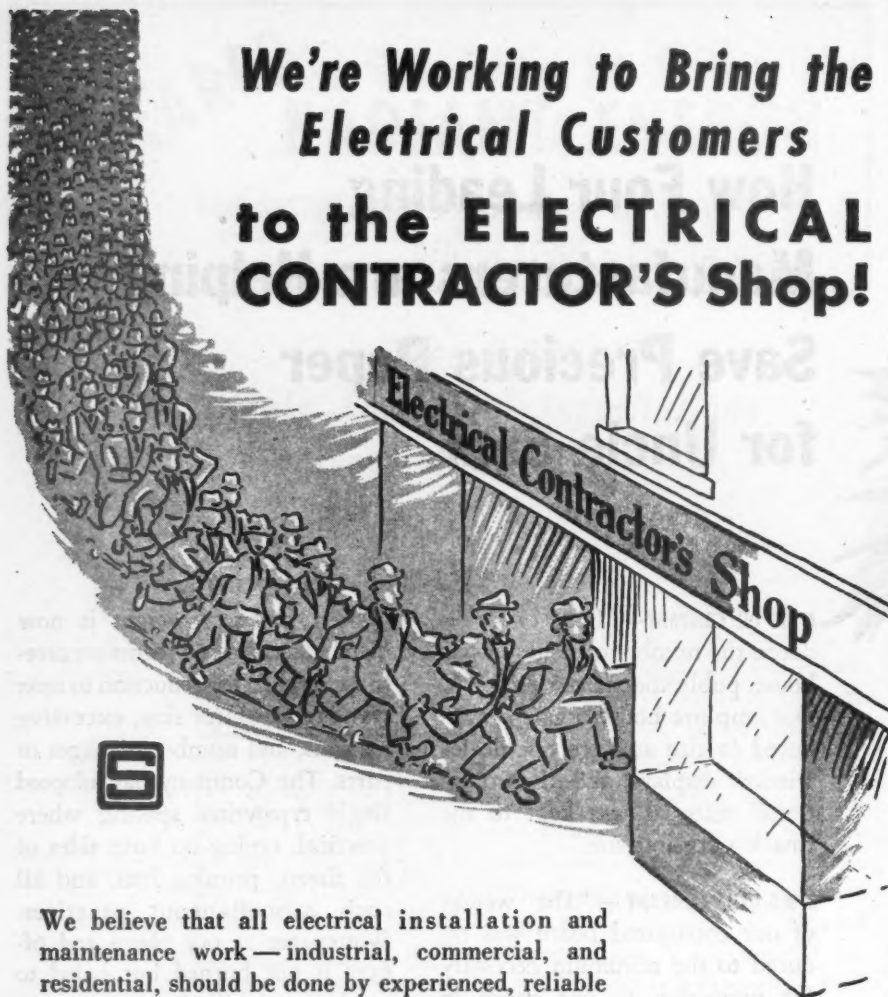
Remember—
**PAPER IS
WAR POWER**



USE LESS PAPER — SAVE ALL WASTEPAPER

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

We're Working to Bring the Electrical Customers to the ELECTRICAL CONTRACTOR'S Shop!



We believe that all electrical installation and maintenance work — industrial, commercial, and residential, should be done by experienced, reliable Electrical Contractors. And we are determined to do everything we can to bring the electrical business back to the shop of the Electrical Contractor, *where it belongs.*

We have therefore launched an advertising campaign in which we are going to tell electrical buyers everywhere why IT PAYS to consult a competent Electrical Contractor whenever there is electrical power, lighting, or control equipment to be installed or repaired.

We are going to tell the public that the Electrical Contractor is the *only* man who has the training, experience, and equipment to do good electrical work . . . that the Electrical Contractor *protects the public safety* through his expert knowledge and observance of local codes and regulations. And we are going to urge all branches of the Electrical Industry to support and protect the Electrical Contractor.

This advertising is prepared to help YOU — Mr. Contractor. Watch for it!

H. B. SHERMAN MFG. CO.
BATTLE CREEK, MICHIGAN

Sherman

**ELECTRICAL
SPECIALTIES**

Sherman

**Soldering Lugs
Solderless Lugs
Set Screw
Connectors
Bolted Con-
nectors
Fixture Con-
nectors
Ground Clamps
Rigid Ground
Fittings
Electrical
Terminals
Battery Con-
nectors
Splicing
Sleeves
Wedge Grip
Connectors**

ing the overall practical utilization of continuous row lighting.

If the predictions of the Residence Lighting Committee materialize, post-war portable home lamps will provide from 30 to 70 foot-candles of illumination. Chairman H. W. Clum, Jersey Central Power & Light Co., revealed that present IES specifications are lagging far behind home lighting recommended practices but new specifications are being prepared.

A pioneering venture in totally indirect industrial plant lighting was outlined by J. L. Kilpatrick, Westinghouse Electric & Mfg. Co., who described in detail the combination 3-KW mercury and incandescent installation at Budd Field—Ed. G. Budd Company's new plant near Philadelphia. Constructed of reinforced concrete with a dome type roof over each bay, the plant offered ideal conditions for the indirect illumination designed on a basis of about 6 watts per sq. ft. The installation, maintained from a catwalk, provides approximately 30 foot-candles on the working plane.

Describing airport lighting installations developed by the Army and Navy and used in advanced northern bases, Major W. H. Harding, Wright Field, Dayton, Ohio, reviewed the application of above-runway contact lights utilizing 200-watt series lamps with a beam candlepower of about 42,000 which, with the aid of radio aids, permits safe landings under adverse weather conditions. Based on performance tests at these bases, Major Harding predicts the application of these units, which can be operated at reduced intensities for good weather, for modern airport lighting to replace present low candlepower flush contact lights; sees the elimination of floodlights; and the increased use of coordinated light and radio aids for airport operations.

The application of a recording microphotometer to the design of reflector type gun sights by F. E. Carlson and W. M. Potter, G. E. Co.; the use of a spectrophotometer for determining definite color specifications and control on color production processes by W. C. Granville, Interchemical Corp., Research Laboratories; an outline of mercury vapor street lighting in Denver, by D. W. Rowten, Westinghouse Electric & Mfg. Co.; and a discussion of control equipment for discharge type lamps by C. W. Kronmiller, G. E. Co., rounded out the conference technical paper presentations.

Postwar plans in the lighting field were reviewed at a lighting service forum. Future plans as presented by representatives of the various organizations included: NEMA (E. C. Huerkamp)—publication of a fixture application guide, a street lighting plan book and comprehensive promotion of street lighting; RLM Standard Institute (R. W. Staud)—act on specifications for aluminum high bay reflectors, encourage development of new equipment, improve requirements and expand activity to disseminate information on RLM specifications and program; National Better Light Better Sight Bureau (J. S. Schuchert)—has Home Lighting and Commercial and Industrial Lighting Educational Committees, activities of the latter to include the formulation of

HERE ARE TWO QUICK SOLUTIONS TO YOUR LIGHTING PROBLEMS



**TAP THE
"HOW-TO-DO-IT"
ABILITY OF YOUR
WESTINGHOUSE
DISTRIBUTOR**

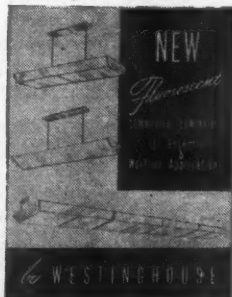
Your Westinghouse distributor offers two quick solutions to your lighting problems.

First: Westinghouse Commercial Fluorescent Luminaires for offices, drafting rooms and other essential applications.

Second: The distributor's own "how-to-do-it" ability representing knowledge drawn from Westinghouse lighting headquarters and experience gained in similar applications for other customers.

Westinghouse distributors carry a complete stock of luminaires—ready for prompt delivery. Used for either individual or continuous strip installations—ceiling or suspension mounted—they provide a wide range of high intensity illumination . . . free from shadows and glare.

Units are ruggedly built . . . easy to install and maintain. Lamps can be replaced without removing glassware . . . all glass panels can be cleaned without disturbing other fixture parts. Westinghouse Fluorescent Luminaires bear the Underwriters' Laboratories label. Ask your Westinghouse distributor about them today. J-90514



GET THIS BULLETIN

This bulletin—B-3332—lists basic types of Westinghouse Commercial Fluorescent Luminaires. It presents complete application data . . . dimensions . . . features . . . methods of mounting . . . ordering information. Ask your nearest Westinghouse distributor for a copy today. Or, write Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N:

SEE YOUR WESTINGHOUSE DISTRIBUTOR FIRST!



Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



NO. 1010
10 AMP.,
125 VOLTS

McGill Levolver switches are hand-assembled and as precise as a fine watch. They are built to stand up under years of heavy duty operation. The switch mechanism is permanently lubricated with a fine grease which does not deteriorate with age.
 ... required

Tested under more exacting conditions than those required by the Underwriter's Laboratories, they last . . . and last. They are made in sizes 3 to 10 ampere capacity, single pole, two circuit, series multiple and 3-way pull.

**Send for catalog showing
complete Levoliier
and companion
electrical lines**

ELECTRICAL DIVISION

McGILL
MANUFACTURING CO., INC.
VALPARAISO, INDIANA

At the postwar store lighting session N. A. Owings, Skidmore, Owings & Merrill, Chicago architects and engineers; H. J. Chapin, Marshall Field & Co., Chicago; and K. C. Welch, Grand Rapids Store Equipment Co., gave their impressions of what store lighting should be like. High points of the discussion were: Merchandise must be highlighted to make it stand out while still maintaining the effect of soft lighting by proper blending of general lighting; overlighted chain store illumination will be modified; experience has proved that 4 to 5 times more light can be had in stores at the same or less cost; there is a market for germicidal lamps in crowded areas of stores such as elevators, rest rooms, children's and nursery departments, etc.; lighting should be of full spectrum type, cool, flexible and of low unit cost per lamp; as lighting intensities increase operating costs decrease; there should be a complete cooperation and understanding between the architect and lighting engineer.

Price regulation No. 251 has been revised to make for more practical, effective price control. This revision places a ceiling on the prices which a contractor or sub-contractor may charge for practically every repair, installation or building job, and at the time of final settlement of a job, the buyer of these services may, if he wishes, ask the contractor for a statement saying that the charge was not more than the ceiling price.

The construction industry may add to presently established ceilings for construction services, increases in wage costs since October 3, 1942, that have been approved or authorized by the Wage Adjustment Board, National War Labor Board or Economic Stabilization Director, the Office of Price Administration has announced.

DOUBLE OPPORTUNITIES for SALES AND PROFIT SELLING AND INSTALLING



Cash in on this profitable market! Every poultry raiser now knows that LIGHTS INCREASE PRODUCTION AND PROFIT. They all want these Poultry Time Switches. Sell them! Install them! The season's short. ACT NOW!

With and without "Dimmer Circuit"
All-electric and Manually-wound

Write for Information

AUTOMATIC ELECTRIC MFG. CO.
MANKATO, MINNESOTA

A STRONGER FACTOR
in TODAY'S NEW
COMPLETE CIRCUIT
PROTECTION



EXTRACTOR POSTS WITH ELECTRICALLY WELDED SIDE TERMINALS

Terminals integral with inner shell mean more strength against extreme shock, vibration and temperatures. Maximum electrical conductivity. New construction for convenience and durability. Shock-proof visual inspection. Specially designed grip prevents fuse from dropping out.

Send for B/P and ENGINEERING DATA
Ask for Samples

342001 finger-operated for 3 A G fuses illustrated. Also furnished screw-driver operated meeting Underwriters' specifications.

LITTELFUSE INCORPORATED
Lf 4757 Ravenswood Ave., Chicago 40, Ill.
 200 Ong St., El Monte, Calif.

My Machine . . .

This is my machine. Mine!
There are many other machines but this one is mine.
It is a part of me—I am a part of it.

We are one.
Together we are forging the weapons of Victory—
Weapons that will strike the shackles from men who would be free—
As I am free!

With Thy help, O Lord, I will bring forth the most and the best
That is possible from my machine.
For it depends on me.
It multiplies the power of my hands—when my hands are on the job.
It does true work—when my brain is alert to control it.
It does not falter—unless I falter.
It does not stop—unless I forget.

In the lands of my enemies, slaves, under the whip,
Labor at their machines.
But I am free!
I abide by my machine of my own free will.
No man is my master—no man my slave.
And this way is best.
It is!

By unfaltering example we shall prove it is best—
My machine and I.
By argosies of ships and tanks and planes,
In the only language the enemy understands,
We shall prove it.
This is our pledge—mine and my machine's—
Till Freedom's light comes on again.

Suggested by "My Rifle"
The Creed of a United States Marine



This war poster, the eighth of a series, is published as a tribute to the men and women in war plants from coast to coast who inspired the message.

GENERAL CABLE CORPORATION

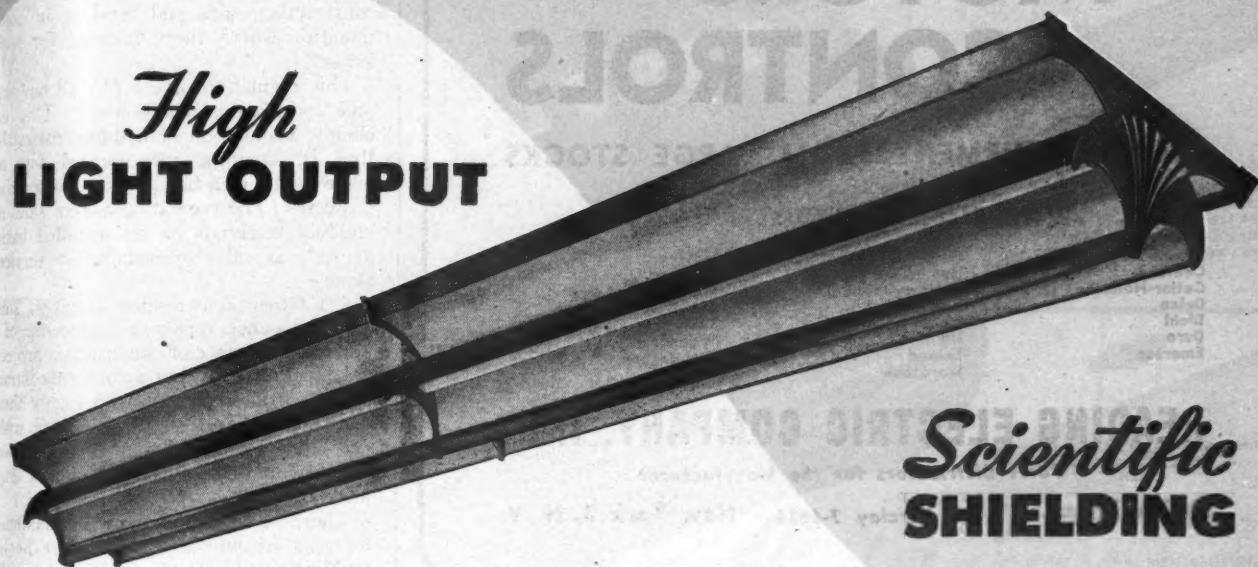
If engaged in war work: larger bulletin board copies (25 x 35 inches) are available with our compliments. Write **GENERAL CABLE CORPORATION**, 420 Lexington Avenue, New York 17, N. Y.



Electric

The Curtis **SKYLUX**

High
LIGHT OUTPUT



Scientific
SHIELDING

FOR TWO 40-WATT FLUORESCENT LAMPS

On "ticklish" jobs, insure yourself against the loss of orders by offering the best—Curtis SkyLux.

The values built into this outstanding unit are sure to please the discriminating buyer. From the standpoint of light output, scientific shielding, maintenance, appearance and workmanship, SkyLux is a winner.

The basic SkyLux principle is patented. A well planned installation will stand the most searching comparison with other lighting systems.

The Curtis representative in your territory will be glad to go over the many SkyLux sales points with you.

If you do not have sufficient copies of our new SkyLux folder, Serial 2167, write for them today.



CURTIS *Lighting, INC.*

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

PARTS

FOR FANS MOTORS CONTROLS

PROMPT SHIPMENT FROM LARGE STOCKS

AUTHORIZED PARTS DISTRIBUTORS

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Century
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Leland
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Master
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READING ELECTRIC COMPANY, INC.

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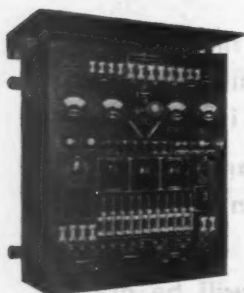
200 William St.

Barclay 7-6616

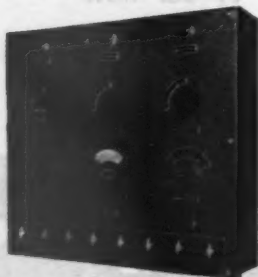
New York 8, N. Y.

Electrical Specialties of Every Type

Including MARINE WORK



WORK TEST PANEL—built to customers' specifications and Navy standards.



RADIO MOTOR-GENERATOR and SELECTOR CONTROL PANEL—built to customers' specifications for any number of circuits.



ALL types of electrical specialties, boxes, cabinets, control panels, duct-work, etc., manufactured by an organization accustomed to meeting exacting Army, Navy and Commercial specifications. Full engineering personnel and equipment for manufacture of special electrical items to customers' needs in addition to all standard articles. Let us quote you on your requirements. Write for illustrated catalog.



Corporation, formerly exempt, are now under regulation. The decline of construction for new plants and war facilities and the recognition of new adjusted wage rates will minimize the effect of this broadened coverage of the regulation.

Other changes include: (1) removal of the requirement that a certification of compliance with the regulation must be given on all sales over \$500 (a certificate is now required only where demand is made by the buyer), and (2) the delegation of authority to Regional Administrators to issue pricing orders for particular kinds, types, or classifications of construction sales and services in communities where there is need for such action.

This regulation covers (1) all building and construction contracting. This includes: installation of building materials that is, anything incorporated into or made a part of a building or construction project. (The regulation covers sales of building materials on an installed basis as well as sales of installation services alone.)

(2) Other construction services, such as maintenance, repair or remodeling of a building, structure or construction project.

It applies to all contractors, subcontractors, and other persons who supply these construction services either with or without the building materials installed, whether on a cost-plus, lump-sum or unit-price basis.

There is no minimum or maximum number of workers who must be on building contractors' payrolls to make these contractors eligible to apply authorized wage increases since October 3, 1942 to their maximum prices without filing an application with the Office of Price Administration.

PROCEDURE FOR OBTAINING MATERIALS FOR MAINTENANCE OR REPAIR WORK

The War Production Board has clarified the use of application forms by which home owners and owners or managers of commercial residential properties and farmers may secure preference ratings to obtain materials for the maintenance or repair of residential buildings or properties.

Commercial residential properties include apartment houses, hotels, rooming and boarding houses, and all other residential property operated as a business.

WPB officials said that commercial residential properties owned or managed as a business are granted an AA-5 preference rating for maintenance, repair and operating supplies under provisions of Controlled Materials Plan Regulation No. 5. Hence, the filing of a separate application form for maintenance or repair materials is not necessary.

It was pointed out, however, that the AA-5 rating granted under CMP Regulation No. 5 may not be used to obtain lumber for maintenance, repair or operating supplies, and that the AA-5 rating

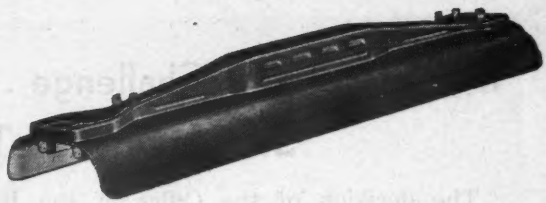
Designed

ENGINEERED MANUFACTURED

Accepted by the trade and specified by leading architects as paramount in the field of fluorescent light fixtures; Leader Units have been installed in ever increasing quantities throughout America's industrial and commercial organization.
The Leader Electric Mfg. Corp. is known

nationally for high standards of quality and workmanship. More important Leader straight-line merchandising methods assure jobber and dealer profits, in this, the fastest growing division of the electrical industry. Your inquiry will receive the prompt attention of Leader Engineers.

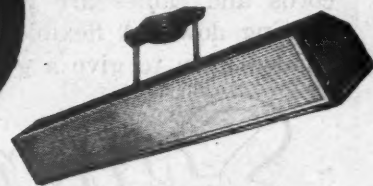
BY *Leader*



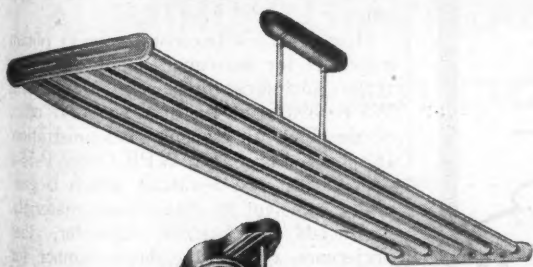
ZUO Series:
Sturdy, streamlined industrial units available in two and three light 40 watt units and two light 100 watt units. Rigid all-steel construction. Designed for individual or continuous run installation.



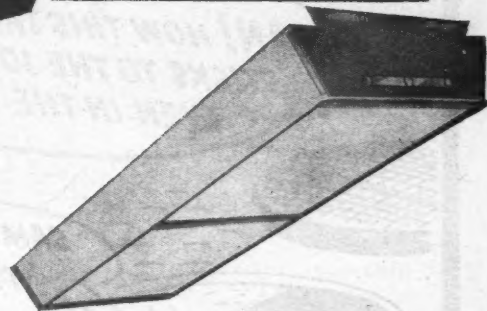
ZIU Series:
Industrial units for concentrated and complex lighting installations, available in two and three light 40 watt units and two light 100 watt units. Designed for individual or continuous run mounting.



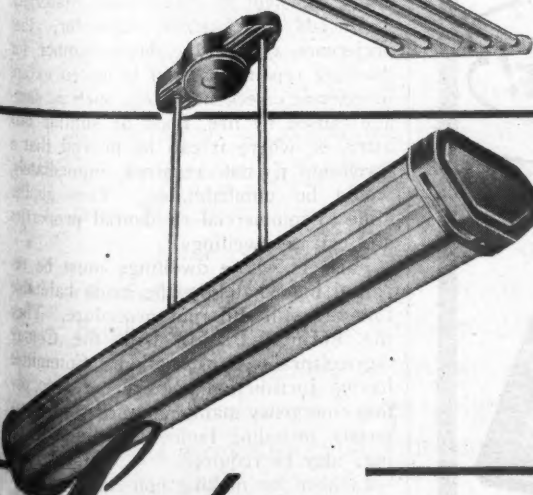
GL-240:
Two light 40 watt, glass enclosed, louvered unit, unusually efficient, designed for pendant or ceiling suspension mounting, constructed for individual or continuous run installation.



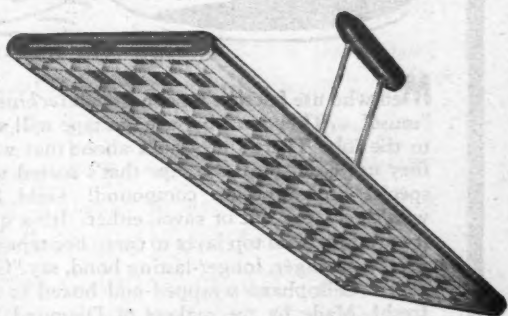
VO-440:
Four light 40 watt, parallel tube, open type luminaire. Remarkably simple to install, maintain, and service. Available for pendant or ceiling suspension mounting, continuous run or individual installation.



LR-440:
Four light 40 watt, glass enclosed unit, manufactured in accordance with the Utilities Research Commission specifications. Available for pendant or ceiling suspension mounting, individual or continuous run mounting.



L-440:
Four light 40 watt, parabolic, open type unit, specifically suited for drafting rooms and war production offices where general overall light is required. Available for pendant or ceiling suspension mounting, continuous run or individual installation.



VL-440:
The LEADER OFFICER — Four light 40 watt plastic enclosed, louvered unit, combining the finest in design, construction, and servicing feature, this unit offers the ultimate in lighting equipment. Available for pendant or ceiling suspension mounting, individual or continuous run installation.

Leader

Distributed only through the Better Electrical Wholesalers

ELECTRIC MANUFACTURING CORPORATION
6127 NORTH BROADWAY CHICAGO 40, ILLINOIS



We Accepted a Challenge . . .

Simplex "War-Tirex" is the Result

The decision of the Office of the Rubber Director that natural rubber could no longer be used in the sheaths of rubber sheathed, flexible cords and cables came as a challenge to us to produce as good or better sheaths with synthetic rubbers. We accepted the challenge with full confidence in our ability to make the most of the available synthetic rubbers but with some doubt as to the possibility of making anything to equal the 60% natural rubber sheath used on TIREX cords and cables for so many years. Results have proved that we underestimated the possibilities.

The flexible, rubber sheaths used at present on all "War-TIREX" cords and cables contain selenium to obtain toughness and are now equivalent to our former natural rubber sheaths in wearing qualities. They are offered by us and may be bought by you with confidence that their performance will be satisfactory wherever flexible cords or cables are needed to supply power for electric tools or equipment.

In mines, quarries, shipyards, mills and factories Simplex-TIREX cords and cables are helping to keep production schedules from slowing down. A flexible cable suitable for rough work can be depended upon to give a good account of itself under any conditions.

Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

MAN! HOW THIS TAPE STICKS TO THE JOB -- EVEN IN THE OPEN!

SAME WAY DOWN HERE! IT'S THE EXTRA-TACKY GOLD SEAL TAPE!

Men who use friction tape most call *tackiness* a "must" . . . They *must* be sure the tape will stick to the job. There's no doubt about that when they use Gold Seal, the tape that's coated with special high-adhesion compound! Gold Seal won't peel, dry out or ravel, either. It's a quality product from top layer to core. For tape that gives a stronger, longer-lasting bond, say "Gold Seal". Cellophane wrapped and boxed to stay fresh! Made by the makers of Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal specifications . . . JENKINS BROS. (Rubber Div.), 80 White St., New York 13, N. Y.

JENKINS Gold Seal Tapes

FRICTION .. RUBBER



A PILOT'S FAITH is in the equipment in his plane, Lt. Col. T. B. Holliday, in charge of U. S. Army Air Forces electrical laboratory at Wright Field, tells engineers at the A.I.E.E. summer technical session in St. Louis.

may not always be sufficient to obtain other needed maintenance or repair materials rated on the priorities system.

Where lumber is required for "emergency" maintenance or repair or where an AA-5 MRO rating has been found to be insufficient for acquiring other materials, persons who own or manage a commercial residence property for profit may apply to WPB for an uprating for individual purchases by filing Form WPB-541 with their nearest WPB field office.

Home owners (except farmers) obtain materials for emergency maintenance or repair, including lumber, by filing Form WPB-2896 with the nearest local office of the Federal Housing Administration. If approved by FHA, WPB Order P-55-c provides an AA-3 rating, which is generally sufficient to obtain most materials.

Officials emphasized, however, that preference ratings to obtain lumber for dwelling repairs will not be given except in extreme emergency cases, such as damage caused by fire, flood or similar disaster, or where it can be proved that a dwelling, if not repaired immediately, would be uninhabitable. This applies alike to commercial residential properties and private dwellings.

Farmers whose dwellings must be repaired immediately to be made habitable follow a still different procedure. They file Form WPB-617 with the County Agricultural Conservation Committee having jurisdiction over the area to obtain emergency maintenance or repair materials, including lumber, for which ratings may be required.

Lumber for making non-emergency repairs on both farm and non-farm dwellings is bought on uncertified and unrated orders from lumber dealers who have been allotted small quantities of lumber to take care of the limited but essential requirements of small consumers, according to WPB.

Aluminum...



..ALUMINUM IS AVAILABLE FOR ALZAK* REFLECTORS

Yes, manufacturers of lighting fixtures can again make reflectors of Alzak Aluminum sheet. No increased manpower is required for this production, so the change from a substitute metal to aluminum may be made by simply requesting the usual allotment number from W.P.B.

To these manufacturers, this means a restoration of products to prewar quality. Bright, specular finishes or matte, diffuse surfaces, or combinations of the two, can be obtained. Aluminum's lighter weight and easy forming properties make fabrication go faster.

*Registered trademark

There's no chipping to run up manufacturing losses.

Users of Alzak Aluminum reflectors gain valuable man-hours on production by having plenty of light exactly where they want it. They save on installation costs, because of the lighter weight of aluminum. They save, too, on maintenance, for it's easy to keep Alzak surfaces clean and reflecting at high efficiency.

ALUMINUM COMPANY OF AMERICA, 1946
Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA



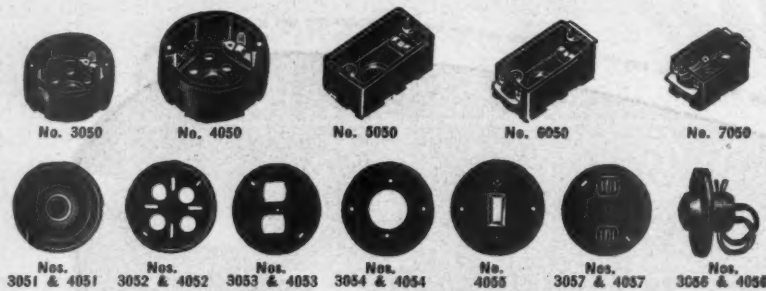
ALUMINUM

Electrical Contracting, October 1944

A Complete Line of **BAKELITE** **OUTLET BOXES and COVERS**

THAT MEET THE NATIONAL ELECTRICAL CODE AND APPROVED BY
FEDERAL HOUSING ADMINISTRATION

BOXES FURNISHED WITH OR WITHOUT CLAMPS



SAFE • ECONOMICAL • DURABLE • NEAT

The sizes and design, except for clamps and wire knockouts, same as standard metal outlet boxes. They take standard type of fixture studs. Two clamps supplied with each box. The wire clamps hold against 125 lbs. pull. When used with fixture studs they withstand over 400 lbs. pull on stud.

These Bakelite Outlet Boxes have side knockouts and clamps to take 14-2, 14-3, and 12-2 non-metallic sheathed cable, and 14-2, 14-3, 12-2 and 12-3 CNX Type Cable and one 1/2 in. Bottom Knockout.

These covers are sufficiently thick to obviate breakage in installation or use. Standard color Black.

UNION INSULATING COMPANY, INC.

FACTORY:
PARKERSBURG, W. VA.

SALES OFFICE:
27 PARK PLACE, N. Y. C.

"VOICE-COVER" MILES OF PLANT with **BELL VOICE PAGING EQUIPMENT**



In addition to complete "voice-coverage"—for broadcasting paging calls, news and instructions—this typical BELL Voice Paging System provides for plant-wide programs of recorded music. It is installed in one of the world's largest automobile plants, where some areas are more than a mile from the broadcasting point!

A convenient "rack-and-panel" arrangement permits Bell units to be combined to fit any need—no



matter how large or small your plant may be. You can divide your plant into any number of "voice-coverage zones," and select the areas you wish each program to reach. BELL Voice Paging Equipment is assembled in rugged, compact units—designed for long, hard service and easy, low-cost expansion or re-arrangement. Write today for details.



BELL SOUND SYSTEMS, INC.
1187 Essex Avenue, Columbus 3, Ohio
Export Office: 4900 Euclid Avenue, Cleveland 3, Ohio

POLICY FOR SPECIAL SALES OF SURPLUS MATERIALS

The War Production Board's policy on special sales of idle and excess controlled materials on an excess allotment authorization has been inserted in a new amendment to rules governing such special sales.

Under this policy, sales of idle and excess controlled materials under Priorities Regulation No. 13 will not be authorized on an excess allotment basis if the proposed use of materials or products would interfere with war production or labor supply needed for war production, WPB officials said.

Most sales of idle and excess controlled materials, however, are made to persons who are directly engaged in war production for the Army, Navy or United States Maritime Commission, or in essential civilian production, and labor checks will not have to be made in such cases, it was explained.

When idle and excess materials are sold for use under the spot authorization rules, contained in Priorities Regulation No. 25, labor checks will be made in connection with the spot procedure and will not be required for authorization of special sales.

Special sales are those made by a person holding material in a form different from that in which he usually sells it.

In addition, the amendment to Priorities Regulation No. 13 points out specifically that its rules govern the sales of surplus materials by Government disposal agencies. This is merely a clarifying amendment. The applicability of Priorities Regulation No. 13 rules to surplus material sales had been questioned.

Under the amendment, idle and excess stocks of copper and copper base alloy may be sold to any warehouse. Formerly, specific WPB authorization was required for sales of such stocks of copper and copper base alloy to warehouses.

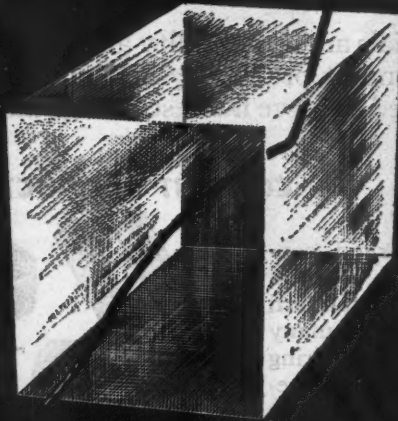
Lists in the regulation have also been modified to change the conditions under which special sales of various finished and semi-finished products and raw materials may be made. Under these changes, all construction machinery, as defined in WPB Order L-192, may be sold to users without WPB authorization.

Under the changed rules, electronic parts and equipment may be sold to distributors or wholesalers without WPB authorization on orders bearing an AA-5 preference rating. Formerly, specific WPB authorization was required before such sales could be made. In addition, rejected components for electronic equipment may now be sold freely (without authorization of preference rated orders) if the services certify that such equipment has no military value.

HIGH POSTWAR CONSTRUCTION VOLUME PREDICTED

A decade of high volume construction markets after the war is predicted in a comprehensive study of postwar prospects by the F. W. Dodge Corporation com-

Laytex Proved Even Better Than We Knew!



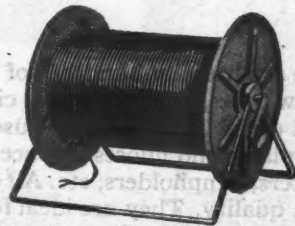
We knew that Laytex-insulated wire was good. But actually, no one expected any single wire to stand up to all the tough war-usage that Laytex did.

Laytex has taken arctic cold, tropic heat, moisture, mold, shock and wear, as no other wire has ever done heretofore. It has been used for virtually every purpose a wire can be used for—action-tested all over the world—and has come out with flying colors.

Laytex has a proven record of delivering more electricity, more dependably, in more jobs than any other wire we know.

Right now the entire output of Laytex Wires and Cables is going to the Armed Forces. But the day is steadily drawing nearer when manufacture will be resumed for Buildings, Police and Fire Alarms, Communications, Signalling, Power, Control, and other exacting services.

RUBBER INSULATION AT ITS BEST



U.S. Laytex
Reg. U. S. Trade Mark

WIRES AND CABLES

SERVING THROUGH SCIENCE TO PIONEER A NEW ELECTRICAL ERA

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.



Wiring and Accessories

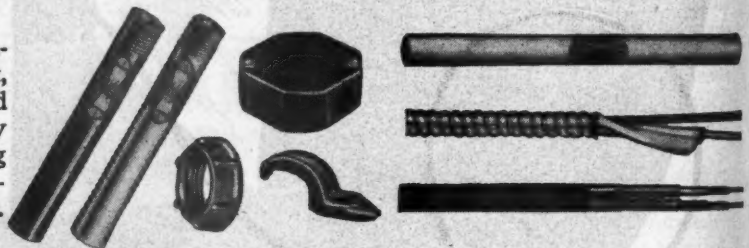
Fluorescent lighting—one of today's outstanding developments—must be properly served to deliver its bright, cool and glareless illumination. General Electric wiring materials and fluorescent accessories can be depended upon to bring the current needed without interruption. There are the right G-E materials for wiring systems in all types of buildings.

G-E WIRING MATERIALS

G-E wiring materials are high quality and give long, dependable service. The line includes conduit products, wires and cables and wiring devices—all materials needed to serve fluorescent lighting.

G-E CONDUIT PRODUCTS

Here are zinc-coated G-E White rigid conduit, enamel-coated G-E Black rigid conduit, electrical metallic tubing and two standard cables, BraidX and BX. There are also many G-E boxes and fittings to use with conduit wiring and with the cables. These materials are carefully made and will meet different wiring needs.



G-E WIRES AND CABLES

In this high quality line are thermo-plastic insulated Flamenol building wires, Type SN for dry locations and Type SNW for wet locations. These wires are small in diameter, resistant to oils, acids and alkalis and are flame retarding. Other wires in the line include Type R and Type RH. There are also a variety of portable cords.



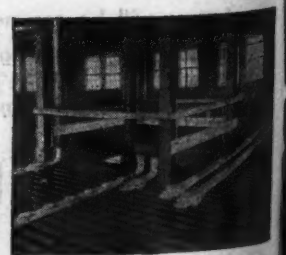
G-E WIRING DEVICES

There are literally hundreds of G-E wiring devices—switches, branch-circuit circuit breakers, enclosed cartridge fuses, plug fuses, convenience outlets, plates and fluorescent accessories including starters, lampholders, etc. All of these devices are high quality. They are ideal for serving, controlling or protecting fluorescent lighting.



Underfloor Electrical Distribution Systems

G-E Fiberduct and G-E Q-Floor Wiring—two different systems for different floors—supplement modern lighting. They add complete electrical flexibility. Outlets can be opened at any time for office machines, appliances, telephone systems, signal systems or desk, bench or counter lighting.



for Modern Lighting

G-E FLUORESCENT ACCESSORIES

General Electric manufactures a complete line of fluorescent accessories which consists of starters, lampholders and starter sockets. G-E Lampholders and Starters are available for all types of fluorescent lamps ranging from mogul to miniature sizes.

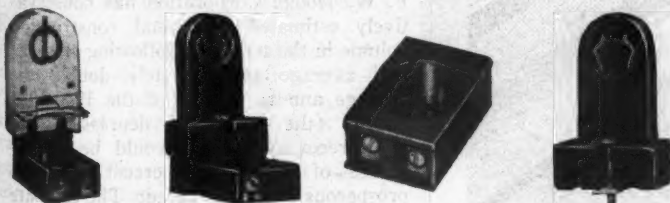
G-E WATCH DOG STARTERS

G-E Watch Dog Starters are gaining nation-wide popularity with lighting engineers and electrical maintenance men because they are helping to reduce maintenance costs substantially. It isn't necessary to make frequent starter replacements. Under specified test conditions the FS-30 and FS-40 outlast ten 30- and 40-watt lamps respectively and the FS-100 outlasts eight 100-watt lamps. This exceeds the approximate life of five ordinary starters.

The Watch Dog eliminates annoying blink and flicker of dying lamps, protects ballasts, saves current and prolongs starter life.



G-E ROTATING LOCK LAMPHOLDERS



G-E Rotating Lock Fluorescent Lampholders are made of rugged plastic and have heavy spring contacts. They are available in black and white Textolite that adds to the appearance of any lighting fixture. G-E Rotating Lampholders are designed to give better and more economical service. They reduce lighting maintenance costs by one-hand lamp insertions and removals. Their design has become the standard of the lighting industry.

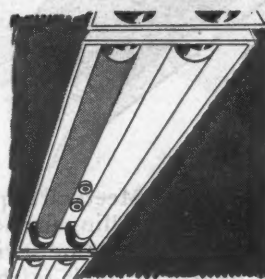
BUY WAR BONDS—AND KEEP THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

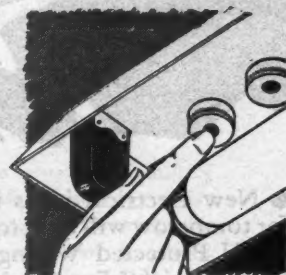
For additional information write to Section CDW-10410-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL  ELECTRIC

REPLACEMENTS ARE EASY

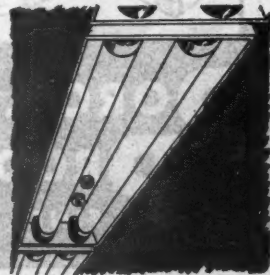
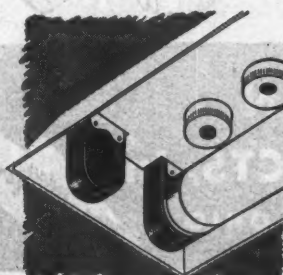


1. Watch Dog Starter immediately locks dead lamp out of circuit. Stops blinking.



2. The manual reset button jumps forward when the lamp fails.

3. After dead lamp is removed, starter is reset by pushing in the colored button.



4. New lamp is inserted and begins to operate normally.

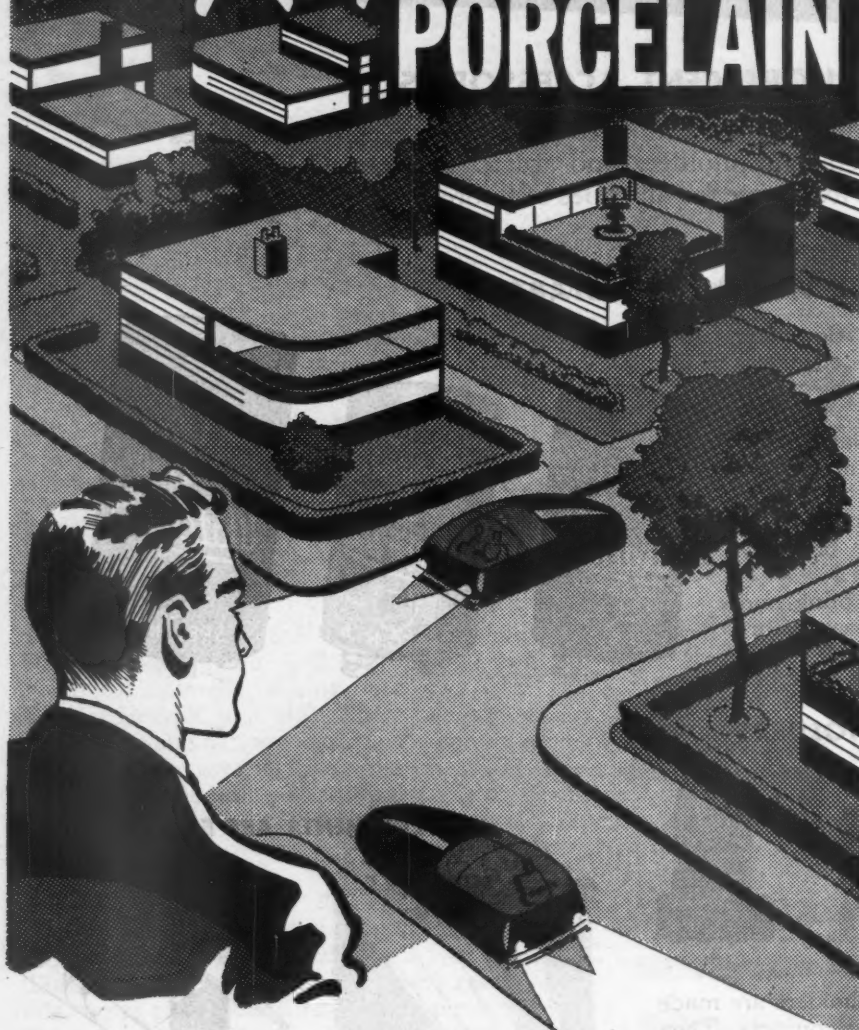
FOR TOMORROW'S **BETTER HOMES**

WIRE

Right

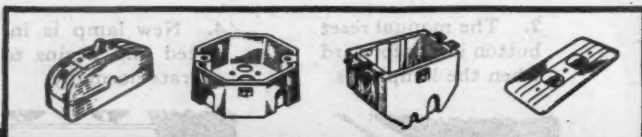
WITH

PORCELAIN



● New electrical ideas in homes for tomorrow will look to PORCELAIN Protected Wiring to carry the load *right!* Experience of half-a-century proves this method—knob and tube wiring—unbeatable for simple installation, low cost, safety, long life and dependability.

Meets all requirements of directives calling for non-metallic wiring and non-metallic wiring materials. Check with your Electrical Inspector for friendly, efficient help concerning fire prevention facts and safety. Write today for wiring manual.



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PP PRODUCTS, Inc.
FINDLAY, OHIO

Write Today for Tomorrow's Load

mittee on postwar construction markets of which Thomas S. Holden is chairman. The study claims that even the most conservative appraisals indicate a huge 10-year market and that this promise is unmistakable in any realistic analysis of the following factors.

- (a) Measures of deferred demands.
- (b) Housing needs of new families and probable replacement demand.
- (c) Prospects of industrial and commercial expansion.
- (d) Anticipated needs for community developments and public improvements.
- (e) Prospective postwar national income.

(f) As a check, comparisons with the postwar period that followed World War I (1920-1929) with careful considerations of similarities and differences.

Against the prospect of much higher national income and the probable carry-over of greater accumulations of purchasing power than after World War I, must be balanced the fact that 1920-1929 was the decade of largest numerical increase in population this country ever had; it was also the decade of largest increase of urban population. The decade 1940-1949 will have only half the numerical increase in total population that actually took place in the 1920-1929 decade. According to Department of Commerce estimates, new family formations will be one-sixth less in number during the current decade than in the decade 1920-1929. These population factors have a direct bearing on residential building demand, and some indirect bearing on construction of facilities that supplement new residential building.

1. F. W. Dodge Corporation Estimates. F. W. Dodge Corporation has conservatively estimated that total construction volume in the ten years following the war will average approximately double the average annual volume of the 1930-1939 decade (the decade of depression and slow recovery). This would be an increase of about five percent over the prosperous 1920-1929 decade. The estimate expresses postwar volumes in terms of prewar cost levels.

Within this increase, residential building volume is expected to average three times the average residential building volume of the 1930-1939 period; non-residential building would increase about 70 percent over its 1930-1939 average; heavy engineering construction would increase about 50 percent. In detail these figures break down as shown in the accompanying table.

If the estimated rates of increase shown in the Dodge table are applied to the Department of Commerce figures, which purport to be overall estimates of all construction volume in continental United States, the following figures result.

Total New Construction Annual Averages	
1920-1929	\$9,158,000,000
1930-1939	4,843,000,000
Postwar Decade	9,623,000,000*

*These figures based on Department of Commerce overall estimates would include farm building at a rate some two and a half times the average annual rate of the 1930-1939 decade. Statistics of farm

building are not reported currently in comprehensive fashion, American agriculture will doubtless remain highly prosperous so long as world food shortages are being made up; it remains to be seen whether there will later be a severe deflation of agriculture similar to that which took place in the 1920's.

The assumed postwar figure shown was exceeded in each of the boom years 1925-1929; it was also exceeded in the war years 1941 and 1942. It was not reached in any other year. Therefore, it has taken, up to the present time, either a construction boom accompanying a great wave of economic expansion or a vast governmental program of preparation for a global war to cause this assumed postwar figure to be exceeded.

2. Some Estimates are Higher—Postwar estimates are current which greatly exceed the Dodge estimates. Dodge considers that arguments about the rightness of advance estimates, considered as predictions of what will happen in the future, are futile. The Dodge organization merely says:

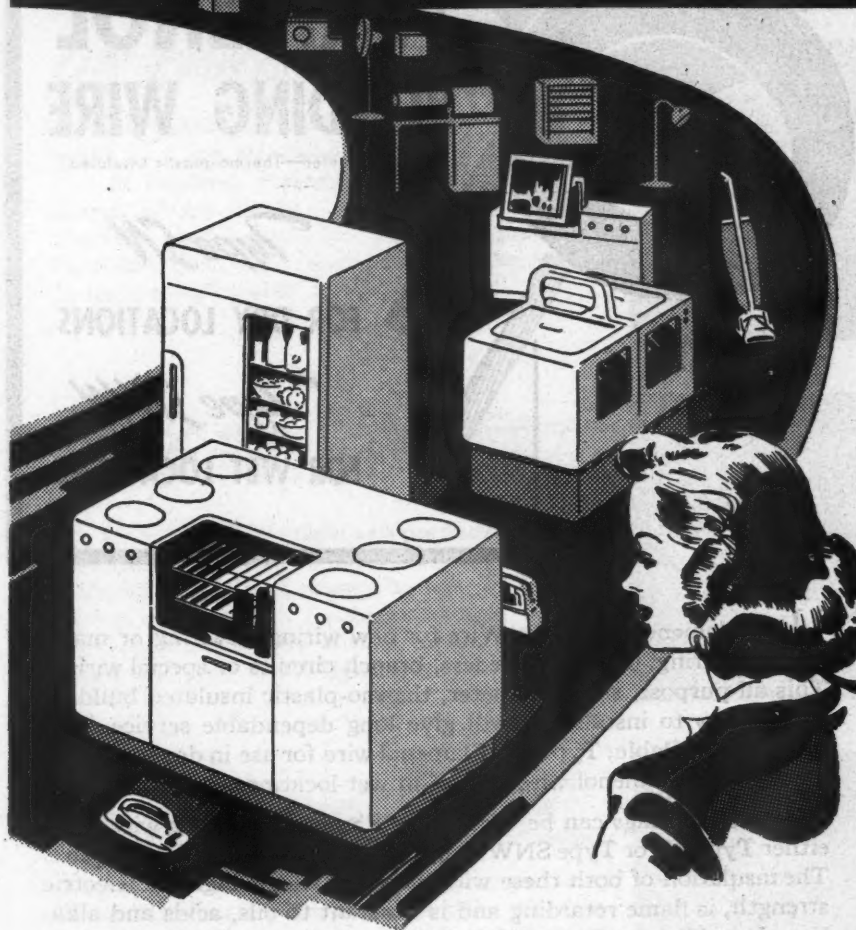
(a) That it believes strongly that the postwar economy will hold opportunities for broad economic expansion after wartime shortages have been caught up, but that it sees at this time no clear indication as to what set of economic factors will dominate such expansion (as the automotive and related industries dominated the expansion of the late 1920's) or as to the character and volume of construction demand that will accompany it.

(b) That later developments in terms of solutions of certain transitional and postwar problems and of actual postwar trends as they become established are rather likely to require upward revision of some or all of the present Dodge estimates.

(c) That, given the great adaptability and flexibility of the construction industry, programs made now for the postwar period (either marketing programs or programs for expanding facilities for production of materials), on the basis of moderate estimates, can later be stepped up quite easily to meet demands larger than those anticipated, whereas cutting back for a smaller volume is always more

FOR TOMORROW'S BIGGER LOADS

WIRE *Right* WITH PORCELAIN



● When her dream of new electrical appliances comes true—there'll be a bigger-than-ever load for wiring! Right now's the time to wire adequately with PORCELAIN Protected Wiring!

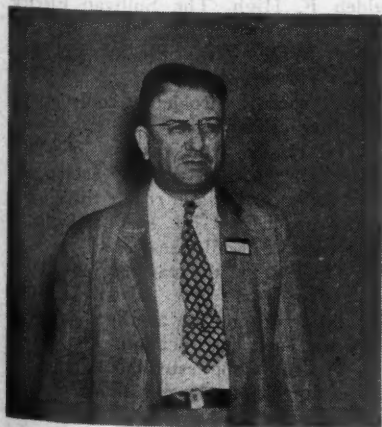
This time-proven way—knob and tube wiring—will carry a greater load in accordance with conductor capacities established by the N.E.C. Do the

job without "frills"—use PORCELAIN for simplest installation, greatest safety, lowest cost, and longest life. Meets all requirements of directives calling for non-metallic wiring materials. Keep in touch with your friendly Electrical Inspector for latest fire-prevention facts. Write today for wiring manual.



PORCELAIN
PP PRODUCTS, Inc.
FINDLAY, OHIO

Wire Today for Tomorrow's Load



GENERAL INTEREST in electric heating for the postwar home was reported by B. H. Martin, Chattanooga, T.V.A. electrical engineer who presented case studies of installations to the A.I.E.E. summer technical session in St. Louis recently.



For Complete Wiring Systems USE FLAMENOL BUILDING WIRE

(Small Diameter—Thermo-plastic Insulated)

Type SN

FOR DRY LOCATIONS

Type SNW

FOR WET LOCATIONS

Approved by
the Underwriters'

USE Flamenol* Building Wire for new wiring, rewiring or maintenance wiring. Use it for feeders, branch circuits or special wiring. This all-purpose, small diameter, thermo-plastic insulated building wire is easy to install and will give long dependable service. Two types are available: Type SN Flamenol wire for use in dry locations; Type SNW Flamenol wire for use in wet locations.

Whole buildings can be wired with Flamenol Building wire using either Type SN or Type SNW or both—whatever conditions require. The insulation of both these wires has long life, is high in dielectric strength, is flame retarding and is resistant to oils, acids and alkalis. In addition, Type SNW Flamenol wire insulation has low moisture absorption.

For further information see the nearest G-E Merchandise Distributor or mail the coupon for descriptive folders.

General Electric Company, Section W1041-8
Appliance and Merchandise Dept.,
Bridgeport, Conn.

Sirs: Please send me the folders on Type SNW and
Type SN Flamenol Small Diameter Building Wire.

Name _____

Address _____

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BUY WAR BONDS AND KEEP THEM

Hear the General Electric
radio programs: "The G-E
All Girl Orchestra" Sun-
day 10 P.M. EWT, NBC.
"The World Today" news
every weekday 6:45 P.M.
EWT, CBS.

*Reg. U.S. Pat. Off.

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difficult. In short, a moderate under-expansion of the construction industry for meeting actual postwar demands is much easier to correct later and much less likely to create future troubles than would be a great over-expansion. (NOTE—In 1942 the industry was able to carry through, with minimum difficulty and delay, the largest program in history, more than double the volume of 1939; on the other hand, the construction industry has in the past gotten into serious difficulties through overexpansion based on over-optimistic estimates of future potentials, as in the 1937 abortive building boom.)

Construction Contract Volume by Decades

	Postwar Decade	Over 1930-1939
Commercial	475	92%
Manufacturing	210	33%
Educational	300	53%
Hospitals and Institutions	150	85%
Public Buildings	120	11%
Religious Buildings	95	150%
Social and Recreational.	145	99%
Miscellaneous	80	220%

NON RESIDENTIAL.	1,575	70%
RESIDENTIAL	2,157	200%

Total Building	3,732	127%
Heavy Construction.....	1,425	50%

TOTAL CONSTRUCTION	5,157	99%
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LAUNDER HEADS NISA LABOR RELATIONS

John E. Launder, Independent Electric Machinery Co., Kansas City, Mo., has been appointed chairman of the Labor Relations Committee of the National Industrial Service Association—national motor repair shop organization. Other motor shop men appointed to serve with Mr. Launder are M. M. Argo, Birmingham Electric & Mfg. Co.; Birmingham, Ala.; C. C. French, French-Gerleman Electric Co., St. Louis, Mo.; Wm. S. Giles, Giles Armature & Electric Works, Marion, Ill.; H. E. Grant, Tennessee Electric Motor Service, Nashville, Tenn.; Selden F. High, The Sullivan Electric Co., Cincinnati, Ohio; and Frank W. Willey, Willey-Wray Electric Co., Cincinnati, Ohio.

Four specific problems confront the committee. They are:

1. To classify the various jobs in a modern electrical repair shop equipped to make coils, rewind and repair three-phase motors up to 500 hp. size, and single-phase motors of all sizes.
2. To describe the various jobs classified above.
3. To determine the average maximum wage for each classification.
4. To draft a suggested labor contract—setting forth job classifications, rates of pay, overtime rates, working hours, holidays, etc., that would be fair to both employee and employer.

Past experience in obtaining wage increases from the War Labor Board for motor shop employees has indicated the urgent need for such classifications.

NATION WIDE ASSOCIATION OF ENGINEERS FAVORED

A nation wide association of engineers, embracing all branches of that profession, was advocated recently by C. A. Powel, newly-elected president of the American Institute of Electrical Engineers, and an international authority on power plant problems.

Speaking before the Los Angeles Section Meeting of the AIEE, Mr. Powel declared that "in a world where scientific knowledge and engineering achievement are shaping our habits of thought and life, there is urgent need for an all-inclusive organization that can speak for engineers in the councils of government and the ranks of industry."

Mr. Powel, who is manager of Headquarters Engineering of the Westinghouse Electric and Manufacturing Company, said that such an organization must have "constant and intimate contact with the rank and file of engineers and must bring its weight to bear in community and civic affairs."

"The desire for collective action," Mr. Powel stated, "is as powerful among engineers as it is among members of labor or 'white-collar' unions. What form that collective action should take is the main question facing members of the profession today."

Two plans of joint action have already been tried, he reported. The first, put into effect by the American Society of Civil Engineers, authorizes local sections of the ASCE to set themselves up as collective bargaining units. The second plan favors the inclusion of engineers in the general "white-collar unions."

"Both of these plans offer serious difficulties," Mr. Powel asserted. "The first would probably mean the elimination of supervisory workers from the bargaining units and in addition present a number of legal obstacles. The second plan, while attractive in some respects, has several disadvantages."

"In any concern, no matter what size, the relation of engineers to draftsmen, clerks, accountants and others is almost of necessity small. In addition, the engineer would be subjected to decisions and rules which are clearly intended for a great majority of men doing an entirely different class of work."

He disclosed that the AIEE had formed a joint committee with the American Society of Mechanical Engineers to investigate the subject of collective bargaining units for local Society sections, and added that "their preliminary study has brought out the tremendous difficulties of such a plan."

NEW HOUSES MADE AVAILABLE BY NHA

More than 7,000 war housing accommodations are immediately available and 5,500 more are under construction to assist the War Manpower Commission's current drive to recruit thousands of

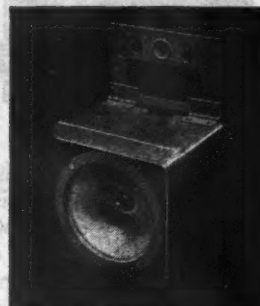
PITTSBURGH REFLECTOR COMPANY'S

Lighting FOR FIGHTING

ON LAND



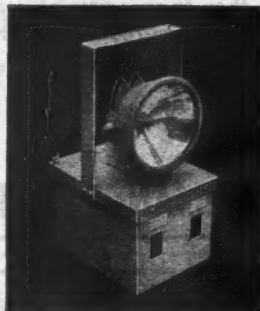
for U. S. ARMY ENGINEER CORPS - At dead of night . . . on blacked-out roads and trails . . . in England, France, Italy, Burma, and the islands of the Pacific . . . wherever American power is on the move . . . Pittsburgh-produced **FLASHER BEACONS** direct tanks, trucks, troops in the onward march to victory.



ON SEA



for U. S. NAVY - Pittsburgh-produced **Electric Emergency Lanterns** . . . hand-portable, equipped with flood-light and storage battery . . . simple, strong, dependable . . . are performing yeoman service in emergency damage control work on board all types of our fighting ships.



IN THE AIR



for U. S. ARMY AIR CORPS. - **Cockpit Lamp Assembly** - The Air Corps drew up the specifications for it. In record time Pittsburgh lighting engineers produced a successful model. Now, mounted on all combat aircraft, from control panel to gun turrets, equipped with extension cord and providing suitable intensities of light for varying conditions, including blackout flying, these cockpit lamps provide "quick seeing" for any task.



PITTSBURGH REFLECTOR COMPANY takes deep satisfaction in being called upon to produce these and many other important war items . . . as well as in supplying **Permaflexor illuminating equipment** adapted to the needs of our armed forces at home and abroad. Into the production of these war items went the same engineering experience and craftsmanship which has made "Pittsburgh" synonymous with **QUALITY** and **PERFORMANCE** in the commercial and industrial lighting field.

**PITTSBURGH
REFLECTOR CO.**
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING
ENGINEERS
DESIGNERS &
MANUFACTURERS
of
COMMERCIAL &
INDUSTRIAL
LIGHTING
EQUIPMENT

• Now producing confidential lighting equipment for the Armed Forces and supplying Industrial users on priority (Commercial replacements from stock). Startling new post-war developments now in work will soon be announced.



You get the BEST in Time Switch Experience WITH BADGER

• This BADGER Synchronous Automatic Time Switch is specifically a heavy duty model with a capacity great enough to meet a wide variety of requirements. There is constant demand for these sturdily constructed time switches with more than thirty years of proven dependability to recommend them.

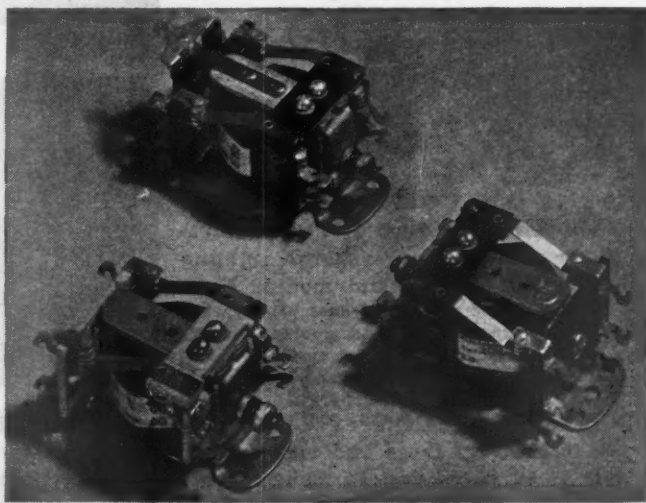
They are completely automatic and are furnished in single and double pole construction with indoor and outdoor cases.

You can guarantee accurate timing, economical operation, and years of dependable service for your customers. See your Wholesaler or send for catalog.

• Prompt delivery on orders rated AA-5 or Higher.

Type	Poles	Switch Capacity	Case
M1 (Synchronous)	1	50 A. at 125 V.	16 Ga. Steel
M2 "	2	50 A. at 125/250 V.	16 Ga. Steel
RM "	1	50 A. at 125 V.	Cast Iron
RM5 "	2	50 A. at 125/250 V.	Cast Iron

RELIANCE AUTOMATIC LIGHTING CO. RACINE WISCONSIN



ADAPTABLE FOR MANY PURPOSES



Only 1 1/4" high. For continuous operation on AC and DC voltages up to 110-115. Double pole, double throw. Send for Bulletin 104.

The Ward Leonard Midget Metal Base Relay has proven so satisfactory and dependable that several adaptations have been made in it to give it even wider application. These relays may be furnished with studs in place of metal bases.



WARD LEONARD
RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) devices since 1892.

WARD LEONARD ELECTRIC CO., 28 South St., Mount Vernon, N. Y.

additional workers for expanded production of heavy ordnance, John B. Blandford, Jr., Administrator of the National Housing Agency, has reported.

These quarters are open for immediate occupancy in 54 localities which will feel the main employment impact of the move to meet the greatly increased needs stemming from current military operations in Europe and the Pacific and from the almost continuous bombing of enemy objectives, Mr. Blandford said.

In the great majority of these areas the supply of war housing already available or under construction will be ample to meet the needs of the new recruitment drive, according to Mr. Blandford. However, in some localities additional housing will be needed to accommodate the workers to be recruited—estimated at 50,000—and negotiations are under way between NHA and the War Department as to its construction. A substantial proportion of the 50,000 workers sought will be secured from the local labor supply in ordnance plant localities and will not require additional housing.

MILWAUKEE LEAGUE STARTS LECTURE COURSE

The Electrical League of Milwaukee started on September 18 a lecture course for its members and the members of the Electrical Maintenance Engineers of Milwaukee. These lectures are held weekly and some of the subjects to be discussed are—Progress in the design of fluorescent equipment; Induction and dielectric heating; What is good lighting and how do we get it; Industrial applications of photocells; six uses of an oscillograph in a modern plant; How d.c. motors fit your job; How to use simple a.c. motors; Specialized a.c. motor application; and Drives—fitting the motor to the machine.

I.A.E.L. PLANS POST V-DAY ACTION

With victory on the European front definitely in sight and with the country on the threshold of reconversion to civilian needs, the International Association of Electrical Leagues, with more than 140 registered, held their 9th Annual Conference at Deroit's Book Cadillac Hotel, September 20-22nd, to review methods of translating plans into action for more electrical jobs after V-Day.

In his keynote address, President W. A. Ritt, Minneapolis, stressed the conference theme of translating plans into action now. Noting that electrical dealers will be back bigger than ever, he cautioned against glamorizing the electrical appliance business as the ideal enterprise for returning servicemen. New appliance dealers and salesmen must be highly trained to promote, sell and service the new products the public will demand, he added, reiterating the dire need for farm electrical equipment dealers.

The germ of an idea born at last year's Cincinnati meeting has grown into a reality in California, reported Victor W. Hartley, Los Angeles, as he outlined the organization and operation of Home Planners Institutes designed to educate the home buying and modernizing public in the latest features of home construction, planning, plumbing, heating, wiring, lighting and electrical labor saving kitchen and laundry aids as well as interior and exterior decorating. Based on the successful operation of nine Institutes in Southern California, seven others are being planned for this fall, he reported, adding that a wiring appraisal chart, developed to aid financial institution appraisers in determining the value of wiring in a home, was an outgrowth of H.P.I. activities. Before the end of this year, 20 to 25 home planning institutions will be in operation in the central and northern sections of the state, he reported.

Observing the increased acceptance of adequate wiring by the builder who wants a label to sell his houses and by financial institutions who recognize wiring as a factor in home obsolescence, J. S. Bartlett, Washington, D. C., chairman, N.A.W.B. Plan Committee, urged intensive local promotion of adequate wiring and home certification now as preliminary ground work for a proposed over-all electrical living plan which will promote the plus features of such electrical living accessories as ranges, laundry aids, water heaters, air conditioning and others. Revealing that the A.W. minimum standards are being revised upward and that the N.A.W. Bureau is expanding its staff and promotional activities, he pointed to the predicted home building boom, war housing and farms as the vast potential market.

League delegates were given an insight into the practical problems the builder faces in providing complete electrically equipped homes at a price that 80 percent of the population can afford. Discussing some of these problems, W. J. Guinan, Executive Director, Builders Association of Metropolitan Detroit, stated that adequate wiring and maximum amount of electrical equipment cannot be furnished in a house costing less than \$6,000; that F.H.A. mortgages must be extended up to perhaps 40 years to lower monthly payments so the \$2,500 per year and under income group can enjoy these living comforts. So the builder can serve this stable portion of the population, Mr. Guinan revealed that the National Home Builders' Association will present a program to Congress next spring advocating extension of mortgage terms on F.H.A. financed homes. The practice of government agencies giving the same mortgage commitments on a well equipped home and on a home with equipment "streamlined" presents an obstacle to selling the better home, he added. Metropolitan Detroit has a postwar housing program involving the construction of 30,000 new units and the demolition of 10,000 old units annually for 10 years, he reported.

One whole session was devoted to the review of postwar potential markets and problems in the electric appliance sales field. One important factor in appliance



KLEINS

FOR YOUR PROPOSED EXPANSION



Plans of public utility companies call for a large increase in power lines, communication lines and transport facilities as soon as war conditions permit the release of material and manpower.

For whatever plans you are making, be sure to include Klein tools and equipment to aid your men to do better work—to do it faster—to guard their safety.



The name Klein has stood for the finest in tools and equipment for linemen since the first wires were strung. As advanced technology has demanded new tools, the Klein line has kept pace.

As soon as the war ends, Klein equipment will be available, representing tops in quality as it has "since 1857."

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp.
New York



This book on the care and safe use of tools will be sent without charge upon request

Since 1857



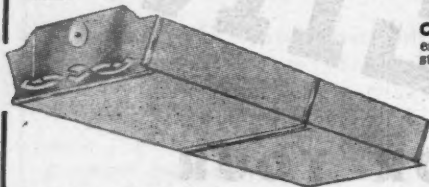
Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.

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"ALL-BRITE" FLUORESCENTS

Ask for literature on our COMPLETE LINE of Fluorescent Fixtures RIGHT NOW! Let us acquaint you with the superior points of "ALL-BRITE" FLUORESCENTS. OUR PRICES and DISCOUNTS ARE AS GOOD OR BETTER THAN ALL OTHERS. All Types and Sizes Available—immediate delivery on all rated orders.

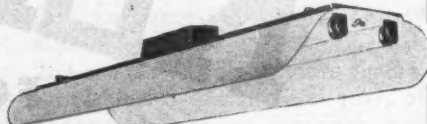
All Four-Foot Units available in INSTA-START. This latest development eliminates starting switches. Lamp lights instantly even at low temperatures. The INSTA-START is widely recognized and approved. Stroboscopic effect is reduced to a minimum. The fixture lights at the flick of the wall switch. No starters to replace or maintain.



U. R. C. STREAMLINER—BALLAST or INSTA-START—meets specifications of Utility Research Commission—high intensity illumination with low brightness—glass or louvre bottom. For flush, stem, or continuous mounting.



COMMANDER—BALLAST or INSTA-START—newest addition to our line—for offices, drafting rooms, stores, etc., where minimum glare is a requisite.



INDUSTRIAL-LITE—BALLAST or INSTA-START—metal or non-metallic reflectors. WIDE Reflectors finished in snow white double baked wax enamel. Metal Reflectors are of 18 gauge steel or heavier.

New Fluorescent

"ALL-BRITE" Victory Models

- CAPTAIN
- CHAMPION
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These are exposed lamp units

All sizes and designs.

Milwaukee's Fluorescent Manufacturer

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JACKSON

Rural LIGHTING



No. 2800



No. 2802

VAPOR PROOF UNITS

Now made in Aluminum

The 2800 at left has a cast aluminum hood tapped for 1/2" pipe. For 60-100 Watt Lamp.

The 2804 for 150-200 Watt Lamp.

The 2802 at right is an outlet box type and can be mounted on either a 3 1/4" or 4" box. For 60-100 Watt Lamp.



No. 8972

QUALITY

YARDLIGHTS

No. 8972—12" Porcelain Enameled Reflector.

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Wired complete—for REA installations.

• Available at your Electrical Wholesaler or Write us for Name and Address of Closest Distributor

• Ready for immediate shipment

• Manufacturers of Industrial Lighting Equipment

JACKSON ELECTRICAL COMPANY

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sales programs is the establishment of a local potential market in each community or area, said W. F. Switzer, manager, Market Research and Organization Department, Frigidaire Division, General Motors Corporation, as he went on to develop and discuss 53 factors that, in addition to the statistical angle, enter into the establishment of proper appliance potentials. Three broad fundamentals affect these potentials: the consumer's interest in owning, his ability to buy, and his ability to use an appliance, all factors in which local economy and electric league and utility educational promotion play a big role, he continued. Local potentials cannot be determined by a simple formula. Use of the best local statistics as a base and application of your best knowledge and judgment of varying local conditions to adjust the potential unit the basic statistics establish is the solution, he added. An orderly method of handling postwar trade-in units must be devised, he concluded, in pointing out the vast postwar appliance market.

Retailers and wholesalers must act now to gear themselves to handle about double their previous high appliances sales volume, cautioned J. S. Bartlett, Washington, D. C., as he outlined the local survey his association made.

Predicting a peak appliance sales of \$2,500,000,000 in 194X, and an estimated 3,000 salesmen of electrical products, including manufacturers and retailers, M. E. Rodger, Customer Service and Sales Manager, Middle West Service Company, Chicago, outlined the program and aims of the newly organized National Electrical Retailers Association of which he is the coordinator. Among N.E.R.A.'s objectives are qualification of retailers and their thorough training to enable them to tell the adequate wiring, better light, better sight and electrical living stories, he revealed as he urged local association and league support and suggestions.

A new approach to the rural and residential markets through consumer interest in what electrical appliances will do was presented by A. H. Kessler, N.C.E.I., Minneapolis. Through consumer contact, each league or group receives complaints, suggestions, recommendations, and ideas pertaining to electrical goods and services. Few have any planned procedure to relay such data to the proper industry channels, he revealed. Mr. Kessler's recommendation that each League forward such suggestions monthly to the International League Office in New York for screening and referral to the proper NEMA Product Committee for consideration was approved at the I.A.E.L. Business Session. The plan recommends a cooperative incentive program sponsored by NEMA and the Leagues.

Discussing the future of lighting in the commercial and industrial markets, J. L. Kilpatrick, Illuminating Engineer, Lamp Division, Westinghouse Electric and Mfg. Company, predicted a \$1,500,000,000 lighting business in 1948 and a doubling of the lighting equipment and lamp market in the next ten years. Brightness engineering is coming into the lighting picture, he

FOR EASY WIRING AND INSTALLATION BUY *Revere* LIGHTING EQUIPMENT

It's the complete
Quality Line



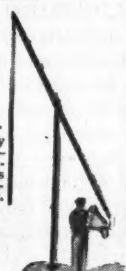
4200 Series
ENCLOSED TYPE FLOOD

A masterpiece
in design and
construction.
Rotates in
yoke for easy,
safe maintenance.



3800 Series REVERE ELIPTOR.

Ingeniously
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neat — stream-
lined. Gives
effective uni-
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—Safety—no haz-
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Service flood-
lights from the
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Originators of the Hinged Floodlight Pole

INDOOR and OUTDOOR LIGHTING EQUIPMENT of EVERY DESCRIPTION

HEAVY DUTY Carbon Lamps

FOR INDUSTRIAL USE

• Recommended for use
where Long Life is essential,
where Vibration is exces-
sive, where Inaccessibility
of lighting fixtures makes
Replacement Difficult, where
a Pilot Light is needed.

Available in a wide variety
of sizes, shapes, candle
power and voltages — stan-
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A large supply of all standard types
are carried in stock, thus assuring
you prompt service at all times.
Write for catalog sheet 1-2
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ELECTRIC LAMP CO.

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FLOOR
BOXES

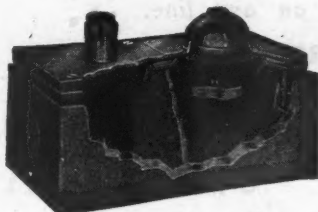
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WIRING
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QUICKLY INSTALLED — EFFICIENT

Reconversion jobs will soon be pressing for attention.
On all such, installation time can be saved and best
results obtained by the use of Latrobe Products.



NO. 252R FLOOR BOX

This convenient two gang adjustable
floor box with No. 208 Receptacle in one
section has one Cover Plate with 1/2"
flush brass plug and one with 2" flush
brass plug.



NO. 480 "BULL DOG"
ARMORED CABLE SUPPORT

Light but strong. For hanging armored
cable to steelwork. Right for temporary
and for permanent jobs.



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TOM THUMB UTILITY OUTLET

Designed to be used in wood installations
and in other locations free from moisture
or mechanical injury.



NO. 284 NOZZLE

A compact Duplex Receptacle Nozzle.
Shown with No. 200 Cover Plate. Fur-
nished with 1/2" or 3/4" brass pipe ex-
tension.

"BULL DOG"
INSULATOR SUPPORT



Fine for fastening
porcelain and glass
insulators to exposed
steel framework.

FULLMAN
MANUFACTURING CO.
LATROBE, PA.

QUALITY

ALWAYS

MULTI

Reflectors

YOUR POST-WAR OPPORTUNITY ... NEED FOR BETTER LIGHTING

★ One thing that has been brought out very strongly by war work is the need for GOOD lighting in plants, shops, stores, etc. It has been established that good lighting improves efficiency so the first step in the right direction is to pick the best lighting units available. Contractors who know pick MULTI Reflectors —

they're modern, require a minimum of maintenance, and give no after worries. This is your foundation for good post-war business—select the proper unit from the very complete MULTI line whether you need commercial or industrial fixtures and whether they are for indoor or outdoor installations.

● Send for the MULTI catalog which gives complete facts on our line.

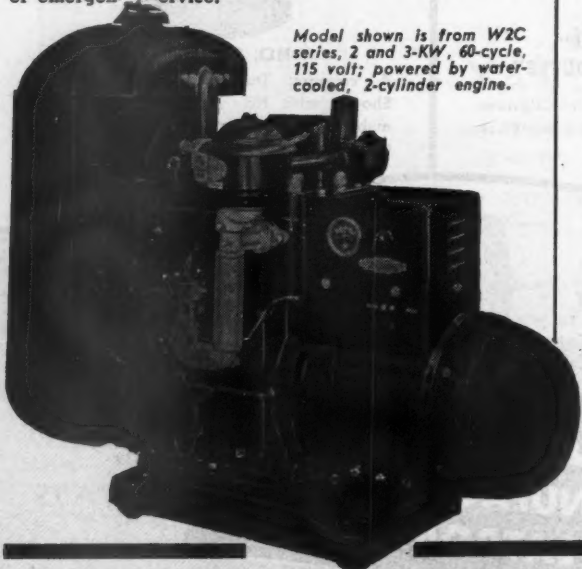
MULTI

ELECTRICAL MANUFACTURING CO.
1840 WEST 14th ST. CHICAGO, ILL.

ELECTRICITY For Any Job—Anywhere

Reliable, economical electric service for electrical contracting projects anywhere, anytime, with an Onan Electric Generating Plant. From the 65 basic models, the right plant for any job or application, large or small, can be selected. Driven by Onan built, 4-cycle gasoline engines, these power plants are of single-unit, compact design and sturdy construction. Suitable for all mobile, stationary or emergency service.

Model shown is from W2C series, 2 and 3-KW, 60-cycle, 115 volt; powered by water-cooled, 2-cylinder engine.



Over 65 models, ranging in sizes from 350 to 35,000 watts. A.C. types are 50 to 800 cycles, 115 to 660 volts, single or three phase; D.C. types from 6 to 4000 volts. Dual A.C.-D.C. combination types available. Write for engineering assistance or detailed literature.

*Over 200,000
In Service*

D. W. ONAN & SONS

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added as he illustrated latest developments in industrial and commercial lighting and indulged in a bit of imagineering along postwar lighting lines.

A means of getting adequate high quality electrical equipment into the homes of the 80 percent of the population in the \$2,500 per year or under group, is provided by the proposed complete home program presented by Richard M. Jones, western manager, *Architectural Forum*. Basically, it is a plan for financing refrigerators, ranges and other appliances under the long term amortized home mortgage.

Reviewing the opportunities for electrical equipping and modernization in the commercial market, W. T. Stuart, editor, *Electrical Contracting*, predicted a total of \$1,768,000,000 for commercial construction annually for five postwar years. The electrical share of this construction dollar will be substantially larger in percentage than in prewar years, he revealed, adding that electrical materials alone, exclusive of lighting fixtures, will approximate \$125,000,000 annually. A large factor in the postwar commercial market potential will be modernization, tenant changes and rewiring of existing buildings, and that the electrical market ahead will go beyond anything we dare to predict.

Covering the industrial modernization market, B. J. Martin, editor, *Electrified Industry*, stated that there are many electrical industrial processes that will make products 25 percent cheaper or one-third better in quality, and he urged a broad selling program to show industry how to accomplish this.

Closing the open sessions of the Conference, D. P. Caverly, Commercial Engineer, Sylvania Electric Products, Inc., gave a comprehensive and highly interesting outline and demonstration of the board application and electronic devices in industrial and other fields.

E. P. Zachman, Cincinnati was elected president; V. W. Hartley, Los Angeles, vice-president; O. C. Small, New York, secretary; and J. A. Morrison, Philadelphia, treasurer.

Book Reviews— LIGHT, VISION AND SEEING

Answers to all practical questions concerning seeing, in their relation to light and vision, are fully and clearly explained in the new book entitled "Light, Vision and Seeing" by Dr. Matthew Luckiesh, director of General Electric Lamp Department's Lighting Research Laboratory. He has coordinated and simplified the highly complex subject of light, brightness, vision, lighting, and human seeing. It is the 24th work of the director of General Electric Lamp Department's Lighting Research Laboratory at Nela Park, Cleveland.

Complex data are presented by means of simple diagrams. Discussions deal with controllable aids to seeing.

The final chapter in the book lists and briefly answers one hundred of the questions most frequently asked about eye-sight and vision, light and brightness.

light and color, daylight outdoors and indoors, light and lighting, and about: light, visibility and seeing.

Among the questions answered are: What is normal vision? What is a diop-ter? What is myopia? What is the dif-ference between an ophthalmologist and an optometrist? How many blind persons in the U. S.? What is a lumen? What is brightness? How many colors are there? What is the ideal lighting system? What is the difference between vision and see-ing? What is glare and why does it affect seeing?

The book is designed to fill the need for a simplified presentation of the science of seeing as a helpful contribution to the lamp and lighting industry and its allies in promoting better, safer, and easier see-ing during and after the war.

Light, Vision & Seeing, by Matthew Luckiesh, D.Sc., D.E., published by D. Van Nostrand Co., Inc., N. Y., \$4.50.

DATES AHEAD

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Indiana, October 1-5.

New York Chapter IAEI—Auditorium Electrical & Gas Assn. of New York, 480 Lexington Ave., New York, N. Y., October 2.

International Municipal Signal Assn.—Annual meeting, Hotel Statler, Boston, Mass., October 2-4.

Greater Central Valley Chapter IAEI—Monthly meeting, 1010 25th Street, Sacramento, Calif., October 3.

Utah Chapter IAEI—Monthly meeting, Salt Lake City, Utah, October 3.

National Safety Congress of National Safety Council—Sherman, Morrison and LaSalle Hotels, Chicago, Ill., Oct. 3-5.

National Electronic Conference—Medina Club, Chicago, Ill., October 5-7.

George Washington Chapter IAEI—Monthly meeting, District Building, Washington, D. C., October 9.

Rocky Mountain Chapter IAEI—Monthly meeting, Denver, Colo., October 10.

Independent Electrical Contractors Assn., Inc.—Monthly meeting, Electrical & Gas Assn. of New York, 480 Lexington Ave., New York, N. Y., October 11.

Eastern New England Chapter IAEI—United Shoe Machinery Building, Boston, Mass., October 18.

Roger Williams Chapter IAEI—Monthly meeting, Providence, R. I., October 18.

Electronic Parts and Equipment Industry Conference—Stevens Hotel, Chicago, October 19-21.

Long Island Chapter IAEI—at Long Isl- and Lighting Company auditorium, Mineola, N. Y., October 20.

National Electrical Manufacturers Assn.—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27.

North California Chapter IAEI—Pacific Gas & Electric Company auditorium, San Francisco, Calif., October 25.

Utah Chapter IAEI—Monthly meeting, Auditorium of Utah Power and Light Co., Salt Lake City, Utah, November 7.

George Washington Chapter IAEI—Monthly meeting, District Building, Washington, D. C., November 13.

Rocky Mountain Chapter IAEI—Monthly meeting, Denver, Colo., November 14.

Roger Williams Chapter IAEI—Monthly meeting, Providence, R. I., Nov. 15.

Electrical & Gas Association of N. Y.—Thanksgiving Luncheon, Grand Ball- room, Hotel Astor, New York, N. Y., November 22.

Southern California Chapter IAEI—Pasa- dena, Calif., November 22.

Kentucky Chapter IAEI—Louisville, Ky., January 11 and 12, 1945.

Indiana Chapter IAEI—Antlers Hotel, Indianapolis, Ind., February 1-2, 1945.

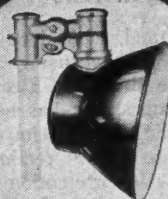
National Electrical Manufacturers Assn.—Spring Conference, Palmer House, Chicago, Ill., April 16-19, 1945.

International Lighting Exposition—Palmer House, Chicago, Ill., April 19-23, 1945.

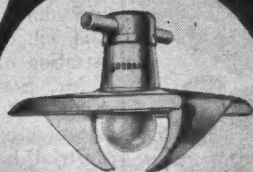
National Electrical Wholesalers Assn.—Spring meeting, April 23-25, 1945.

OUTDOORS...

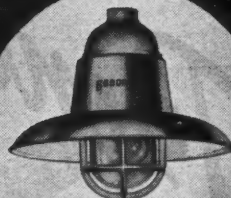
...INDOORS



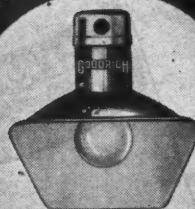
FLOODLIGHT



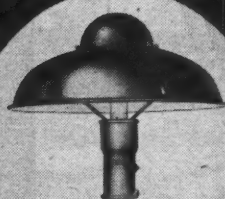
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Lighting

for Every Industrial Need

WHATEVER your industrial lighting problem may be, Goodrich has the experience—and the equipment—to furnish the proper solution.

From its wide selection of flood- lights through literally hundreds of sizes, styles of reflectors for every lighting requirement, the Goodrich line is complete, including many

special and exclusive designs. Goodrich reflectors are designed for high reflective efficiency—for easy installation and easy servicing.

Goodrich's entire interests are devoted to industrial illumination. Goodrich lighting specialists will gladly recommend the equipment to properly answer your needs.



Sold through electrical wholesalers

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4600 BELLE PLAINE AVENUE, CHICAGO 41, ILLINOIS

The Product of the

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VICTORY LINE

Victory Line of 22 capacitance ratings in electrolytic capacitors for 110-volt operation; 6 ratings for 220-volt.

These 28 universal types can take care of upwards of 90% of all motor-starting capacitor replacements.

Handy Aerovox conversion chart indicates Victory equivalent for any previously available type.

● It's well to bear in mind that Aerovox was the first to introduce the high-capacitance dry electrolytic capacitor for motor-starting functions. Aerovox has continued its pioneering in this field. Today, faced with wartime restrictions, Aerovox is providing a Victory Line of essential capacitors whereby you can keep those refrigerators going for the duration, at least. Consult our local popper regarding Aerovox Victory Motor Starting Capacitors. Or write us direct.

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MANUFACTURERS NEWS

STAUD APPOINTED DIRECTOR OF PUBLIC RELATIONS

Rudolf W. Staud, who since 1927 has been in charge of advertising and sales promotion at the Benjamin Electric Mfg. Co., at Des Plaines, Ill., has been made director of public relations for the company. In addition, he will retain his former duties as sales promotion manager and will continue to assist in the administration of the sales organization.

Mr. Staud is president of the RLM Standards Institute—a specification, inspection and certification program for industrial lighting equipment. He also is



R. W. STAUD

chairman of the Public Information Committee of the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association and director of publicity for the International Lighting Exposition. He is a director and member of the Finance Committee of the Illuminating Engineering Society, a member of the Commercial and Industrial Lighting Planning Committee of the Better Light, Better Sight Bureau and a member of the American Marketing Association.

G-E CHANGES

Owen D. Young and Gerard Swope resigned September 8 as chairman of the board and president respectively of the General Electric Company and Charles E. Wilson was reelected president at the board of directors meeting in New York. No announcement of a successor to Mr. Young as chairman was made.

G-E is expanding its Glyptal Alkyd resins according to C. K. Mead, sales manager of the resin and insulation materials division. The new Glyptal field force set-up is as follows: F. M. Hastings will be in charge of the New York area with offices at 570 Lexington Avenue, New York; C. H. Gross will handle the Atlantic seaboard district



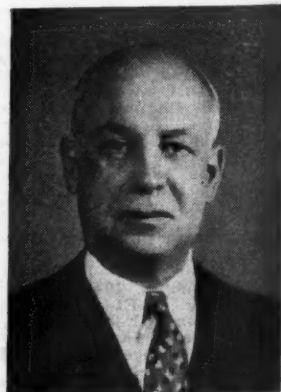
C. E. WILSON

except for the New York area with headquarters in Schenectady, N. Y.; P. E. Doell, in charge of the East Central district will make his office at 1966 Woodland Avenue, Cleveland, Ohio; J. R. Reid and R. C. Reid, in charge of the Central District will have their offices at 840 South Canal Street, Chicago. Paul W. Wood Company of San Francisco and Los Angeles represents Glyptal on the Pacific Coast. J. E. Russell acts in a similar capacity in the states of Arkansas, Louisiana, Oklahoma and Texas.

General Electric has announced the purchase of a 155-acre plot of ground in Liverpool, five miles from the city of Syracuse, N. Y., and plans to build a new plant when necessary materials are released by the government. This plant will be the headquarters for the company's Electronics Department.

WARD LEONARD ELECTIONS

Leonard Kebler, president of the Ward Leonard Electric Company, became Chairman of the Board of Directors, a newly created post, at a recent meeting. Mr. Kebler, recently elected president of the National Electrical Manufacturers Association, has been with the



L. KEBLER

Ward Leonard Company for 45 years, being made its president in 1904.

Dawson J. Burns, vice president of the company since 1909, was elected to succeed Mr. Kebler as president. Mr. Burns became associated with the firm in 1902.



D. J. BURNS



A. A. BERARD

Arthur A. Berard was elevated to executive vice president and general manager, having served successively as salesman, general works manager, and general sales manager. Mr. Berard joined the company in 1920 and was made a director in 1927.

ALLEN-BRADLEY CHANGES

Frank D. Popowics has joined the sales engineering staff of Allen-Bradley Co., in New York. Mr. Popowics was formerly associated with the electrical division of Colt's Patent Firearms Mfg. Co. in Chicago. C. N. Calkins is district manager.

Charles M. McCoombs, formerly New England district manager for Bull Dog Electric Products Co. has joined the sales engineering staff of Allen-Bradley Co., in Boston, as assistant to M. H. Hallenbeck, district manager.

WESTINGHOUSE APPOINTMENTS

Harry A. Kinley, affiliated with the Westinghouse Lamp Division for 34 years, has been appointed manager of its district office at Detroit, Mich. Mr. Kinley's territory embraces most of Michigan and northwestern Ohio, including Toledo and Lima.

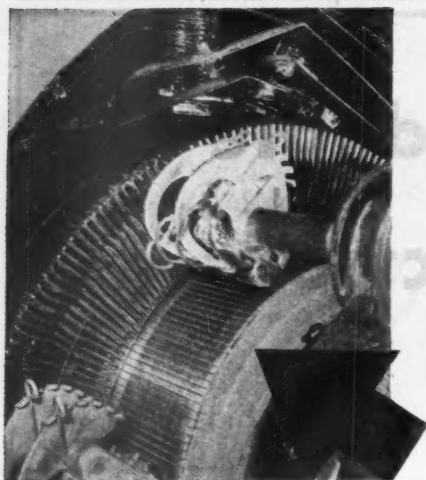
Dependable Protection



MONARCH FUSE COMPANY, LTD.

116 E. FIRST STREET

JAMESTOWN, N. Y.



How to get MORE SERVICE from motors

Carbonization of the lubricating and cutting oils that seep into the interstices of commutator segments is largely responsible for the burn-outs that occur under overload operation, particularly on non-interpole machines. The inductance voltage between bars during commutation may be high enough to cause arcing after the bars have passed under the brushes and any lubricating oil that has deposited on the mica segments may be carbonized to the extent that actual current flow is permitted from bar to bar.

Thoroughly cleaning the commutator prior to an application of one of DOLPH'S oilproof enamels on the exposed end of the commutator will help to prevent these shorts.

On certain types of commutators that have been in service for some time, shrinkage of the mica segments occurs. This is largely due to the fact that mica segments are built up with mica laminations and these laminations are cemented together with a binder. Aging of the binder may result in a slight change in mica dimensions thus opening capillary cracks which encourage oil seepage and absorption.

An application of one of DOLPH'S oilproof enamels will prevent oil seepage. However, it is suggested that commutator ends be thoroughly cleaned before attempting to apply the enamel. Further information regarding the use of Oilproof Enamels will gladly be supplied upon request.

Dolph's

JOHN C. DOLPH COMPANY

Insulating Varnish Specialists

168-A Emmet St., Newark, New Jersey

Willett R. Wilson, regional lighting control officer for the U. S. Office of Civilian Defense since August, 1942, has joined the Westinghouse Lamp Division's commercial engineering department.

Richard M. Wilson has been named manager of the Marine Division for the Westinghouse Government Office.

Ralph T. Perkins has been appointed Home Appliance manager of the Central District of the Westinghouse Electric Supply Company. He will be in charge of the Ohio-Michigan area, with headquarters in Detroit. Mr. Perkins was formerly Eastern district manager of the Empire Tool Company, New York.

PRICE BROS. APPOINTS MANUFACTURERS' AGENTS

Price Bros., Frederick, Md., announces the appointment of the following manufacturers' agents:

Gerald G. Ryan Co., Chicago, Ill., for Illinois, Wisconsin, Eastern Iowa and Northwestern Indiana.

Bert A. Hansen, Buffalo, N. Y., for New York State, exclusive of metropolitan area.

E. J. Wall, Cleveland, Ohio, for Ohio, Michigan and East and Southern Indiana.

L. R. Ward Co., Dallas, Tex., for Arkansas and Oklahoma.

Fry & Roberts, Hollywood, Calif., for Southern California and Arizona.

Gail Halliday, Denver, Colo., for New Mexico, Colorado, Utah, Wyoming, Idaho and Southern Montana.

WELSBACH CHANGES

James M. Brodbeck, district manager, Welsbach Street Lighting Co., New York, has been appointed division manager, Chicago. In his new capacity, Mr. Brodbeck will supervise in Chicago, St. Louis, and Kansas City the operations of the Welsbach Company. Formerly manager of industrial relations, Northern Indiana Public Service Co., Hammond, Ind., Mr. Brodbeck joined the Welsbach organization in 1938 as field representative. In 1939 he became district manager, St. Louis, and was promoted to district manager in New York in 1940.

James R. Campbell, assistant manager, New York, has been appointed district manager, New York, to replace Mr. Brodbeck. He has been assistant manager since 1940.

General Electric Supply Corporation in New York has announced the appointment of James F. Galloway as manager of Traffic Appliance Sales. He was formerly sales manager of the Heating and Air Conditioning Department of General Electric Co., Metropolitan Branch.

**"LOOK what
you can do!"**



**—with nothing but
a wrench**

**and without
disturbing conduit**

Only with a Kondu fitting
can you loosen two nuts and lift
the box right out of the line—
without disturbing the conduit.
Every Kondu box is a union.



Use a

Threaded or

Threadless Connection

to Thin-Wall or Thick-Wall conduit

At ANY outlet of ANY
Kondu fitting, you can make
either a threaded or threadless
connection — to thin-wall or
thick-wall conduit. Just insert
the suitable bushing.

100% re-usable — Kondu
fittings are practically unbreak-
able. They give you a rigid
and vibration-proof connection.
Roomy enough for all splices.

Write for the Kondu catalog.

KONDU CORPORATION
Erie, Pa.

Kondu Mfg. Co., Ltd., Preston, Ontario

KONDU



The Threadless Fitting
in Unmatched Variety



Graybar Electric Company has announced the appointment of J. A. Mayer as Atlantic District Manager effective November 1. A. L. Hallstrom, now Atlantic District Manager, will act in an advisory capacity until January 15, when he will retire after 50 years of service.

The territory under Mr. Mayer's jurisdiction will include the Graybar offices and warehouses at Allentown, Pa., Baltimore, Md., Harrisburg, Pa., Reading, Pa., and Washington, D. C. His headquarters are in Philadelphia.

Big Electric Ventilating Co. has expanded its San Francisco Branch Office and moved to larger headquarters at 826 Sharon Building, 55 New Montgomery St. James S. Rose, formerly Supervisory Methods Engineer in charge of heating and ventilation, Curtiss-Wright Company, Buffalo, will be the manager of the new office.

Fairbanks, Morse & Co. has purchased the Pomona Pump Company, a division of Joshua Hendy Iron Works in a \$4,000,000 transaction. All physical assets, patents and trade-marks of the Pomona and Westco pump lines were included in the transaction.

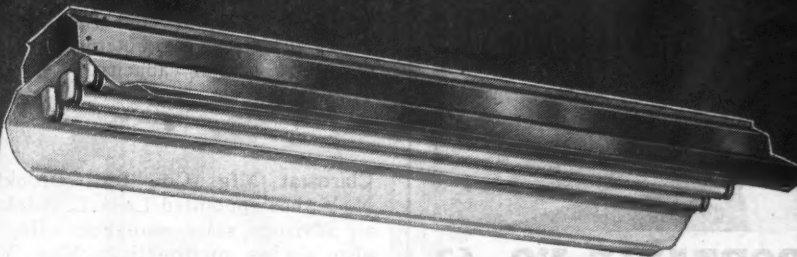
The Square D Company, Detroit, announces the opening of a new manufacturing plant and warehouse located at 2310 Ranier Avenue, Seattle, Wash. Walter H. Bodle has been appointed manager and will direct its operations.

Allis-Chalmers Mfg. Co., has announced the appointment of Frank C. Angle, as manager of all Allis-Chalmers field sales offices of the General Machinery Division and their operations. He is manager of sales activities in the Pacific Region and will continue to supervise these operations.

The O. Z. Electrical Manufacturing Company, Brooklyn, has appointed D. E. Keppler representative in the state of Indiana. His headquarters are located at 616 Knights of Pythias Building, Indianapolis.

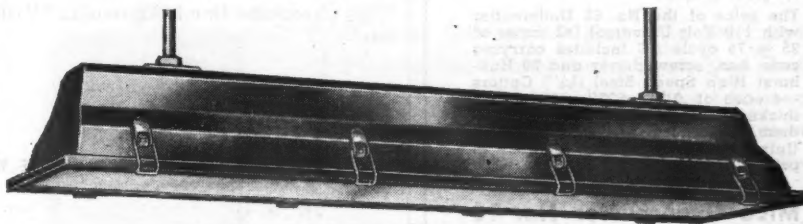
The Instrument Division of Thomas A. Edison, Inc., West Orange, N. J., has named Carl H. Odell as assistant manager. He was formerly with the Federal Telephone and Radio Corp. as an executive in its Direction Finder Division.

EQUIP YOUR PLANT WITH *Skilled Lighting* NOW!



In the light of wartime experience, progressive manufacturers have learned the vital importance of **SKILLED LIGHTING** to speed output and reduce accident. For better production *today* and better products in *peace time*, they are installing Wheeler-engineered fluorescent fixtures *now*.

This is especially true since Wheeler is back in production of the *all-steel unit*—highly-developed product of wartime research plus 63 years of lighting experience. Open-End *all steel* Fluorescent units are available for two 40-watt, three 40-watt and two 100-watt lamps. Units have a broad metal wiring channel, with easily-accessible, enclosed ballast. Can be mounted from chain or conduit, in individual or continuous runs. Messenger Cable, Rod, or Close-to-Ceiling Suspension fittings. Overall fixture efficiency of two 40-watt unit 80%, three 40-watt unit 74% and two 100-watt unit 71%.



ALL-STEEL DUST-TIGHT Fluorescent Fixture for Class II "Group G & F", and Class III and IV Hazardous Locations will prove as efficient and economical in peace time as it is in meeting wartime demands for **SKILLED LIGHTING**, where lamps, sockets and reflecting surfaces must be protected from dusts and vapors. Available for two or three 48-inch, 40-watt lamps.

These dependable units can be supplied with Double-Thick Plain Clear Glass, Water White Plate Glass or Tempered, Clear Safety Plate Glass, mounted in the hinged dust-tight cover.

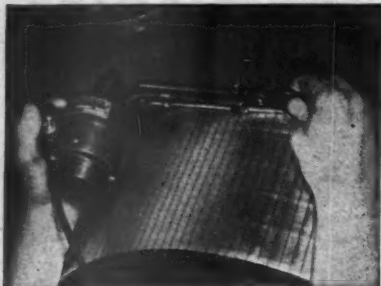
These are but two examples of the high-efficiency light engineering—**SKILLED LIGHTING**—which Wheeler has developed to give maximum visual aid to workers. Write for full details on the complete line of fluorescent and incandescent fixtures. Wheeler Reflector Company, 275 Congress St., Boston 10, Mass. . . . New York, N. Y. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

HULLHORST UNDERCUTTER



PORTABLE NO. 62

• Here is a light weight—compact—handy—portable mica undercutter ideally suited for industrial maintenance men and motor repair shop crews.

LIGHT WEIGHT—weighs only 4 lbs.

COMPACT—Gets into smaller spaces.

CAPACITY—Undercuts horizontal commutators up to 30" dia.

MOTOR—Light, powerful, ball bearing equipped.

SMALL CUTTER—Allows smooth operation, gets closer to riser—lower cutter cost.

BLOWER—Amples for blowing mica dust away for best visibility.

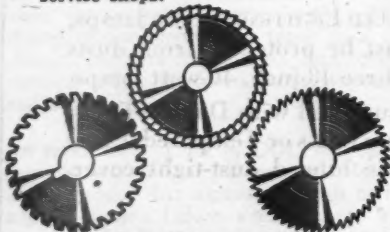
SIMPLICITY—Fewer parts than most undercutters—no flexible shafts to give trouble.

The price of the No. 62 Undercutter with 110 Volt Universal DC motor or 25 to 75 cycle AC includes carrying case, bar, screw driver and 20 Hullhorst High Speed Steel (1/4") Cutters—4 each of .015", .025", .030", .035" thickness or assorted as you want them. Also furnished with 220 Volt Universal motor at slight increase in price.

HULLHORST

Mica Undercutter No. 10

A compact, high production, under-cutting machine, handling armatures up to 6 1/2" in dia. and shafts up to 1 7/8" long. Built specifically for manufacturers and large electrical service shops.



HULLHORST High Speed Steel Commutator Saws

An adequate supply of all important standard sizes is carried in stock. Specify Hullhorst for—faster cutting—longer life—adaptability to all types of Mica Undercutters. In ordering give diameter, hole, thickness and purpose for which intended.

HULLHORST MICRO TOOL CO.

Division of
TOLEDO STANDARD COMMUTATOR CO.
2242 SMEAD AVE.
TOLEDO 6, OHIO

The Hawkins Electric Company, Chicago, recently announced the appointment of E. E. Elliott as manager of their lighting and lamp department. Mr. Elliott comes to his new post from Sylvania Electric Products, Inc., where, for the past year, he represented them as lighting engineer in the Chicago area. For more than eight years prior to that he was connected with the Benjamin Electric Manufacturing Company in a similar capacity.

Clarostat Mfg. Co., Inc., Brooklyn, N. Y., has appointed Leon L. Adelman as advisory sales manager. He will also act as metropolitan New York sales representative, serving the jobbers in that area.

Royal Electric Company, Inc., Pawtucket, R. I., has purchased the fuse division of Colt's Patent Fire Arms Mfg. Co. They have acquired the patents, trademark, tools and equipment for the production of the Colt "Noark" renewable cartridge fuse.

The Rauland Corporation of Chicago has purchased the Phototube Division of GM Laboratories, Inc., Chicago. This phototube line is known as "Visiron".

Practical Methods

(FROM PAGE 98)

VACUUM CLEANER REMOVES DUST

INDUSTRIAL

A new application of vacuum cleaners to industrial processes has been found in its ability to remove surplus chip dust from pieces being worked so that accurate measurements can be made by the operator. The Apex Electrical Manufacturing Company of Cleveland, Ohio, has drafted into service their own Apex vacuum cleaner tanks for the dirt removal. The tank is mounted directly on the machine tool frame so that chips may be drawn away as they are turned by the tool.

In the past, chips were blown out of the various openings, being machined, by compressed air; but instead of improving the overall operations, the chips were pushed somewhere else often clogging mechanisms and driving equipment necessitating serious maintenance and repair work. In addition to the savings obtained in this respect, production efficiency increased eight



QUICK-START Fluorescent Lamp Ballast

The one disadvantage of fluorescent lighting has now been overcome. Time-lag between turning on of switch and lighting of the lamp is a thing of the past. The new Acme Quick-Start fluorescent ballast for use with "Instant-Start" fluorescent lamps eliminates the need for starters and provides instantaneous lamp light. For detailed information write for Bulletin 164.

Another New Advance in Cold Cathode Lighting

The new Acme Cold Cathode lamp ballast is designed for standard 93"—25 mm tubes. Keep informed on the new developments in Cold Cathode lighting. Write for Bulletin 165.

THE ACME ELECTRIC & MFG. CO.
CUBA, N. Y. CLYDE, N. Y.



New Practical Unit to Cut Installation Time

• The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They save considerable materials and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your Jobber.

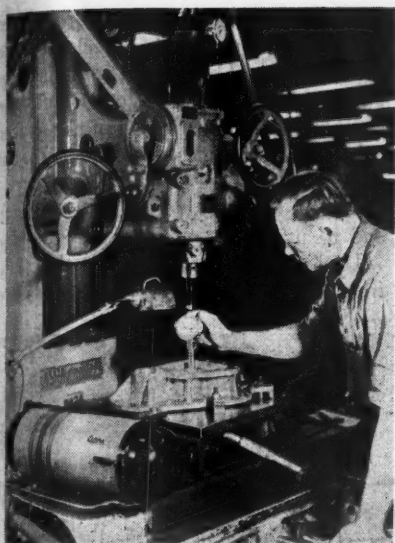


"Messenger Hanger" for Conduit and Cable Strong made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without falling off.

"Messenger Strap" for Outlet Boxes Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Mineralac "Messenger Hanger." Fits all standard outlet boxes and 9/16" messenger cable.

MINERALAC ELECTRIC COMPANY

New York City Office 50 CHURCH ST.
THEODORE B. DALLY
25 N. Peoria St. Chicago



VACUUM CLEANER mounted on machine tools draws away chips to reduce maintenance and to clear work for measuring purposes.

percent during a three month trial period. The increase was attributed to a reduction in rejects and in overall work improvement.

PORTABLE SPOTWELDER FOR TACKING

INDUSTRIAL

Fabrication of aircraft parts for the B-26 has been simplified and accelerated with the introduction of portable spotwelders to tackweld parts together in the assembly fixtures at the Glenn L. Martin Co. plant in Baltimore, Maryland. The new procedure cuts the number of operations in half and has reduced the time required to make the assembly by more than 50 percent.

The portable spotwelder consists of a spotweld machine and transformer, counter-balanced on a small beam pivoting from an overhead trolley traveling along a 50 foot I-beam. The trolley is driven by a sprocket and chain powered by a $\frac{1}{2}$ hp. electric motor. A 200 kva. machine with a welding capacity of two thicknesses of .040 aluminum is used, and the arrangement permits it to operate over a large floor area. Spacers are provided on the I-beam to support the drive chain when the apparatus moves from end to end on the beam.

In the accompanying photo, the driving motor can be seen mounted at one end of the I beam. Idling sprockets are mounted above and below the beam to guide the chain over the driving sprocket. As the motor operates, the welding unit is carried toward the opposite end of the beam by a wire cable. The cable is fastened at one end to the apparatus trolley, pulled over a set

[Continued on page 196]

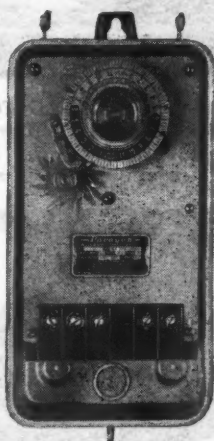
Mr. Tops, the Paragon symbol of top quality.



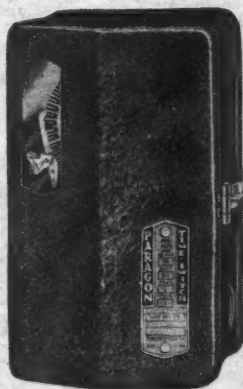
ORDER NOW

*for fall
delivery*

TOP QUALITY POULTRY HOUSE TIME CONTROLS



Model PS



Model 301

TO insure Fall delivery place your order now for Paragon Top Quality Poultry House Time Controls. Paragon "PS" models are designed for both morning and evening lighting, with dimming period for roosting. The Paragon Model 301 is designed essentially for morning lighting only. It is a heavy duty, industrial type time switch adaptable to poultry house lighting. It is truly a superior instrument of high quality and low price. All Models are synchronous motor operated and available on AA5 or better.

Send for Authoritative Bulletin

Paragon has prepared a 4-page, 2 color bulletin containing authoritative information relative to poultry house lighting control . . . location of lights, selection of light control switches, etc. It summarizes the recommendations of leading poultry authorities and gives complete data regarding the wide range of Paragon poultry house time switches. Send for a supply to distribute among your dealers and power companies.

PARAGON ELECTRIC COMPANY
710 Old Colony Building
Chicago 5, Illinois

Paragon Chicago

BUILDERS OF ELECTRICAL EQUIPMENT

SINCE 1905

A SOLUTION



FOR YOUR SWITCH PROBLEM

If you need a switch — whether for residential or industrial use — consult your P&S Catalog. T-rated, specification types — low-cost (residential) types — for use singly or in combinations — brown or ivory, lock type, luminous or metal handles. All precision-made — all backed by over 50 years' experience in the manufacture of wiring devices.

Send for your copy of our No. 42 Catalog

Sold Thru Electrical Wholesalers



PASS & SEYMOUR, INC.
SYRACUSE 9, N. Y.

Practical Methods

[FROM PAGE 195]

of pulleys, and fastened at the other end to the end of the chain.

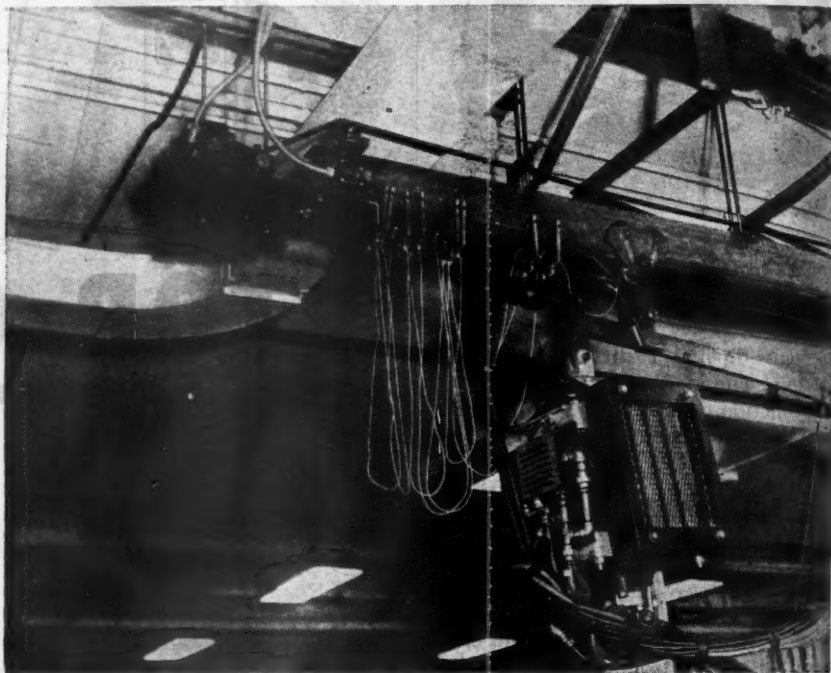
As the trolley moves out, loops of rope provided with equally spaced knots are stretched out which pick up the trolley spacers that support the chain.

Each spacer is provided with two

yokes on opposite ends. The upper yoke is equipped with wheels to ride the I beam. The lower yoke is provided with a roller over which the chain rides. A hole drilled in the spacer permits the rope to slide through but not the knot (see photo).

Limit switches are provided at each end to prevent overtravel.

Under the new procedure the skin, frames and stiffeners for the doors are



PORTABLE SPOTWELD EQUIPMENT carried by overhead trolley. Note the trolley spacers used to carry the chain on the underside of the beam. Limit switch prevents overtravel. Sprockets above and below I-beam guide chain over driving sprocket. One-third horsepower gearmotor used for drive.



BOMB-DAY DOOR assembly being tackwelded by portable spotwelder. Note how entire unit is counter-balanced to facilitate handling by an operator.

all cleaned for spotwelding and assembled in a fixture. They are then tackwelded together with the portable spotwelder, and the entire assembly is then carried to a floor type spotwelder for completion of the welding.

Before the introduction of the portable spotwelder, it was necessary to first assemble the parts in a drill fixture where holes were drilled for skin clamps; then disassemble, clean and burr them for spotwelding; put them together, fasten them with the skin clamps and spotweld them; and finally remove the skin clamps and drive rivets in the holes from which they were taken.

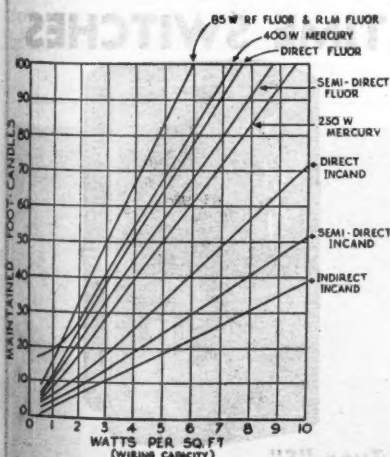
Modern Lighting

(FROM PAGE 156)

SHORT CUT ESTIMATE OF WIRING CAPACITY FOR LIGHTING

Frequently, estimators are called upon to figure a wiring installation before the lighting load has been definitely fixed—particularly in new building construction projects. The safest way to estimate the job is to figure adequate capacity based upon standard recommended levels of illumination for the areas involved. Even though the final lighting design may be below the recommended standards, it will ultimately have to be raised to the proper level and the wiring will be there to take care of it.

The attendant chart provides a handy guide for quickly estimating wiring



capacity for definitely foot-candle levels with various types of lighting fixtures. Presented in the Westinghouse Lighting Handbook, its use involves two simple steps:

1. Determine the proper foot-candle levels for the area involved by reference to the Recommended Standards of Illumination tables (found in all lighting and fixture handbooks).

[Continued on page 198]

The CHAMPION LAMP WORKS



to Improve Your Products to Increase Your Production to Lower Your Costs

You need the best lighting — and the best lamps. 'Round-the-clock emergency production has proved that beyond all question.

CHAMPION's superbly equipped factory and engineering organization concentrates on the production and service of *Fluorescent* and *Incandescent* Lamps for industry.

CHAMPION's trained field men provide prompt and expert assistance on industrial lamp or lighting problems.

CHAMPION's efficient producing and distributing set-up assures lowest cost, lamp for lamp, lighting performance and quality considered. There is a competent and experienced supplier of Champion Lamps near by — ready to meet your particular lighting needs with intelligence and understanding.

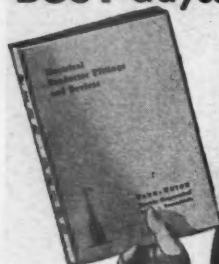


CHAMPION LAMP WORKS

Lynn, Massachusetts

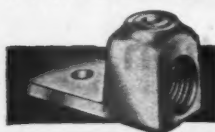
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

"These are
BUSY days!"



SAVE TIME—select your conductor fittings from this Catalog . . ALL good types

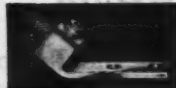
You can buy Tee Connectors, Grounding Clamps, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Service Connectors, Bus Supports, Terminals . . . *practically every good type, in the COMPLETE line.*



**JUST FOR
EXAMPLE—**
here are some
of the standard
Penn-Union Vi-
tite terminal
lugs:



2-bolt flange



45° flange



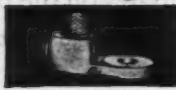
Side flange



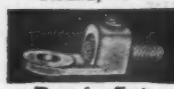
Center tongue



Round, 45°



Round, 90°



Round, offset



Round, center

These types and
many more—in a
complete range of
sizes. Write for Catalog.

Penn-Union connectors are the first
choice of leading utilities, indus-
trials, electrical manufacturers and
contractors. They have found that
"Penn-Union" on a fitting is their
best guarantee of Dependability.

**PENN-UNION
ELECTRIC CORPORATION**
ERIE, PA. Sold by Leading Jobbers

**PENN-
UNION**
Conductor Fittings

Modern Lighting

[FROM PAGE 197]

- On the chart, place a pencil on the horizontal line representing the maintained foot-candle intensity selected and move it to the right until it intersects the curve corresponding to the fixture type to be installed. Then drop vertically from this point of intersection and read the Watts Per Square foot (wiring capacity) value directly below on the abscissa of the chart.

Knowing the Watts Per Sq.ft. and the area of the room, the total required wattage can be determined. With the voltage of the system a known factor, the total wattage can quickly be translated into current value to determine required conductor sizes.

Conductor sizes will be influenced by the distribution of load on branch circuits. Branch circuits are frequently determined by physical conditions.

Motor Shops

[FROM PAGE 108]

BURN-OUT OVEN USES NATURAL DRAFT

A gas-fired burn-out oven is used for pre-stripping operations in Walter J. Rider's motor repair shop in Bing-



BURN-OUT OVEN has been built up against chimney so that natural draft removes smoke and fumes. Center grate is used for stators while rack on right is used for armatures.

KATOLIGHT A. C. GENERATORS

Furnish Same Current as City Power Lines

Kato Engineering products are carrying out an important job in the War Effort.

A maneuvering fighting force cannot arrange for a power line hook-up. KATOLIGHT GENERATORS furnish electricity on the field of battle which permits equipping our fighting forces with the most modern electrical appliances.



"10 K.W. Revolving Field Generator"

Fighting forces need guns, planes, tanks, trucks, kitchens, emergency hospitals, lights, etc. To keep this equipment going, complete repair equipment such as drills, grinders, saws, air-compressors, etc., are needed. Standard A.C. electricity, the same as you get from the power line, must be had for operating these devices. Portable KATOLIGHT GENERATORS supply this electricity. They also supply current for radio transmitters, beacons, landing field controls, etc.

Available in all standard voltages and sizes up through 25,000 watts. Also manufacturers of rotary converters, frequency changers, motor-generators, gas engine driven battery chargers, high frequency motor-generators, and converters.

KATO ENGINEERING COMPANY
637 No. Front St. Mankato, Minn., U. S. A.

AUSTIN TIME SWITCHES



Type "S" Standard Synchronous Model

• Indoor Model—straight "on" and "off"—dust proof—slow speed motor—snap action switch.

Accurate and durable for controlling signs, attic fans, stokers, oil burners, blowers, pumps, valves, motors, and all commercial lighting. Only two exposed gears—modern case and glass window to check operation—no tools or extra attachments needed. See your Wholesaler for more details.

PROMPT DELIVERY—RATING A-5 OR BETTER
THE M.B. AUSTIN COMPANY
108-116 S. Desplaines St., Chicago 6, Ill.

hamton, N. Y. The foundation is built up of cement block and open in the center to accommodate ashes and to provide draft in carrying away smoke and fumes. The oven has been built directly up against a chimney, so by building a canopy of sheet metal over an angle iron frame, a damper-controlled natural draft carries the smoke.

The grate in the center of the boiler-plate table is used for burning out starters. The motor frame is merely set in the center of the grate while the gas burner shoots the flames up through the center. On the right (see photo) is a small frame built of pipe and angle iron with a burner in the center to burn out armature windings.

AUTOMATIC WINDING MACHINE CONTROL

A. C. Loyd, Loyd Electric Co., San Antonio, Texas, firmly believes in reducing the element of human error wherever possible in his motor shop activities. Consequently, he has designed and built an automatic winding machine control that stops the winding head when the required number of turns have been wound on the forms.

The unit consists of an angle iron frame bench with the winding head and "counter" on top and the driving mechanism on a shelf directly underneath. Motive power is furnished by a 1-hp., 110-volt, single-phase, brush-shifting type motor with a 600-1800 rpm. speed range. Through a jack shaft pulley arrangement ($1\frac{1}{2}$ to 1 ratio) the motor drives a worm gear reduction gear box (30 to 1 ratio) providing a 45 to 1 ratio on the winding

[Continued on page 200]



WOMEN TAKE OVER the lighter electrical maintenance chores at Consolidated Vultee's Fort Worth, Texas plant. Here Mary Crow anchors the ladder while Nell A. Clymer replaces a fluorescent lamp in the office area.

for today and for tomorrow

QUAD

Lighting UNITS



RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods

RLM Threaded Dome Reflector

OVER 53% of all jobs done by contractors involve the installation of lighting fixtures. Make your share of these jobs pay you by installing QUAD units. They are modern, easily wired and installed, quickly detachable for cleaning, and highly flexible in design. All units are weatherproof and porcelain finish is permanent. You install them and your job is finished—result is more time for more jobs. For the proper unit for general or specialized installations — indoor or out — make your selection from the very complete QUAD line.

QUADRANGLE MFG. COMPANY

Mfgs. of Incandescent and Fluorescent Lighting Equipment
32 SO. PEORIA ST. CHICAGO, ILL.



For Correct "SPOT" VENTILATION install Blo-Fans

Blo-Fan is more than a fan—more than a blower. It has the advantage of both—*volume of the breeze fan plus power of the blower.*

Installed in ceilings—over the source of greasy kitchen vapors, smoky gameroom odors, steamy vapors in bathrooms and laundries—Blo-Fans capture all the unwanted air before it can penetrate the house.

Blo-Fan

"SPOT" VENTILATION

will be specified by many postwar home builders in your locality because it offers advantages no other ventilator can give... Get in on the ground floor of this profitable line. Be ready to install Blo-Fan as soon as the building ban is lifted.

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1245 E. 33rd St. • LOS ANGELES, 54

BRANCHES TO BE RE-ESTABLISHED AFTER THE WAR:
SAN FRANCISCO • SEATTLE • CHICAGO • NEW YORK

head shaft. Additional speed variation is provided by the foot-pedal which shifts the brushes on the driving motor.

The automatic counting device (See Fig. 1) consists of a 10-inch diameter brass disc whose perimeter contains 200 saw-tooth notches. Mounted on a base plate approximately 30 degrees to the horizontal, this disc is equipped with two pointer arms. One of these arms can be set in a stationary position at any notch desired; the other arm is connected through a worm drive and horizontal reduction gear to the winding head gear box. The ratio is such that one complete revolution of the arm on the counter disc equals 200 revolutions of the winding head shaft.

The automatic feature lies in the fact that when the movable and stationary pointers meet, the winding head stops. Attached to the under side of



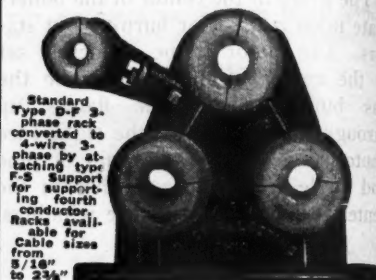
COMPLETE UNIT showing bench and shelf arrangement of winding head, automatic counter and the driving motor and brake mechanism.

each pointer is a collector ring type of contact with a carbon brush. These contacts are connected through a low voltage transformer to the holding coil on the magnetic switch controlling the driving motor. Thus, when the two arms meet, they short out through the transformer and kick out the holding coil on the magnetic switch—stopping the winding head.

Coasting of the winding head shaft is prevented by a novel brake arrangement. Attached to the jack shaft previously mentioned is an ordinary brake drum and band, with the braking tension on the band provided by springs (see Fig. 2). Mounted between the brake drum and the driving motor is a small $\frac{1}{2}$ hp., split phase, 110-volt, single-phase motor with two segments of its rotor cut out. Attached to the motor shaft is a cam which nestles between

[Continued on page 202]

SIMPLICITY PLUS! NEW NON-INDUCTIVE CABLE RACK for INDUSTRIAL PLANT WIRING



Standard Type D-F 3-phase rack converted to 4-wire 3-phase by attaching type F-5 Support for supporting fourth conductor. Racks available for cable sizes from 5/16" to 2 1/4"

Radically different, the new M. & W. Non-Inductive Cable Rack is designed for A.C. or D.C. systems. Racked cables only partially surrounded by metal eliminates any chance of induced current in the rack. Impedance reduced with cables mounted in delta formation. Rack of one-piece construction... installation of cables made quick and easy through the use of split bearings.

Send today for Bulletin C-S-51... describes these and other M. & W. items.

Hook-Mounting and Bar-Type Cable Racks • Messenger Wire and "Bull Dog" Conduit Hangers • "Bull Dog" Insulator Supports • Ground Clamps

**THE M. & W. ELECTRIC
MANUFACTURING CO., INC.**
EAST PALESTINE, OHIO

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1948 how-to-do-it illustrations

• The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 99,000 highly paid electrical workers and engineers.

• Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

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Home Address

City and State

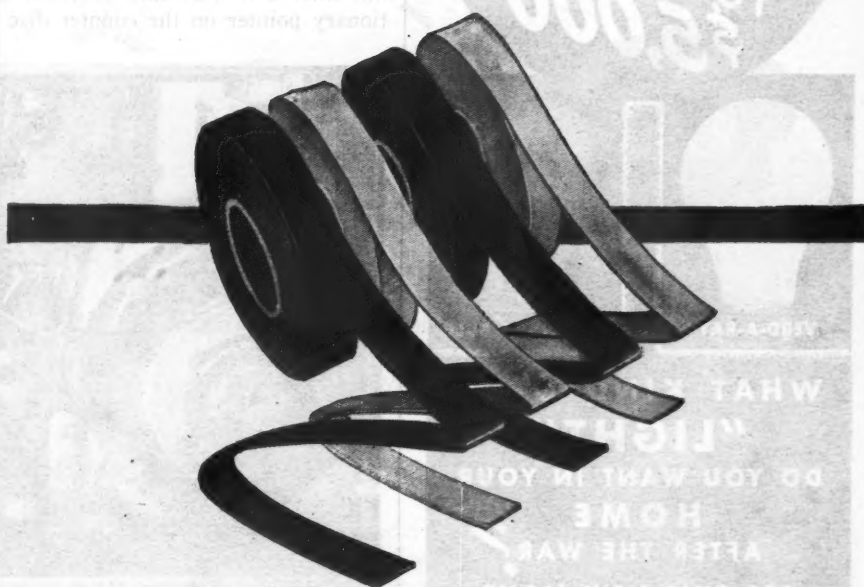
Position

Name of Company.....EC-10-44

What to Look for

in

INSULATING TAPES



Check these facts when selecting insulating tape:

A. The base cloth must: (1) have ample mechanical strength; (2) be chemically inert; (3) contain minimum sizing to permit thorough penetration by the insulating varnish and prevent weakening of the fiber in service.

B. The varnish must: (1) be neutral in relation to the cloth; (2) impart maximum dielectric strength, flexibility and resistance to heat, oil, water or other damaging agents against which the particular tape is to give protection.

C. A ready source of supply for all types of insulating tapes must be available. Your local G-E distributor handles a complete line of tapes, as well as all other insulating materials, and can furnish detailed data and catalog on request. Or send for catalog to Section RIM, 1041-8 Resin and Insulation Materials Division, General Electric Company, Schenectady, N. Y.

There is a G-E Insulating Tape for every need.

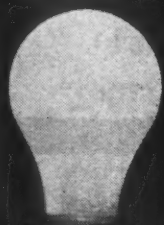
GENERAL ELECTRIC

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS

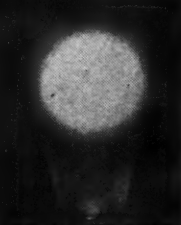
WRITE A SLOGAN...

WIN

\$1,000.00
IN WAR BONDS
OR ONE OF 28
OTHER PRIZES
TOTALING
\$5,000.00



VERD-A-RAY



ORDINARY BULB

WHAT KIND OF A
"LIGHT"
DO YOU WANT IN YOUR
HOME
AFTER THE WAR?
SEE THIS NEW LIGHT
AT YOUR DEALER'S

● VERD-A-RAY is a new type of incandescent light bulb scientifically designed to make seeing easier. In comparison with the "pinkish" white light of ordinary frosted lamps, note the comforting "pastel greenish" white light emitted by VERD-A-RAY.

Scientific research data indicates improved visual (sharpness) acuity, relief from eyestrain and reduced glare.

Many war plants use VERD-A-RAY; one such plant reporting in a trade paper that hospital treated headaches were reduced 69.13%, hospital treated minor accidents were reduced 54%, and 357 productive manhours were saved in one department in one month after proper installation of this new "glareless" lamp.

Nothing to buy. Your dealer has entry form and rules of contest. If not, write direct. Any combination of six words or less, descriptive of VERD-A-RAY may win a prize.

SEE YOUR DEALER
OR WRITE TODAY

VERD-A-RAY

CORPORATION
TOLEDO 5, OHIO

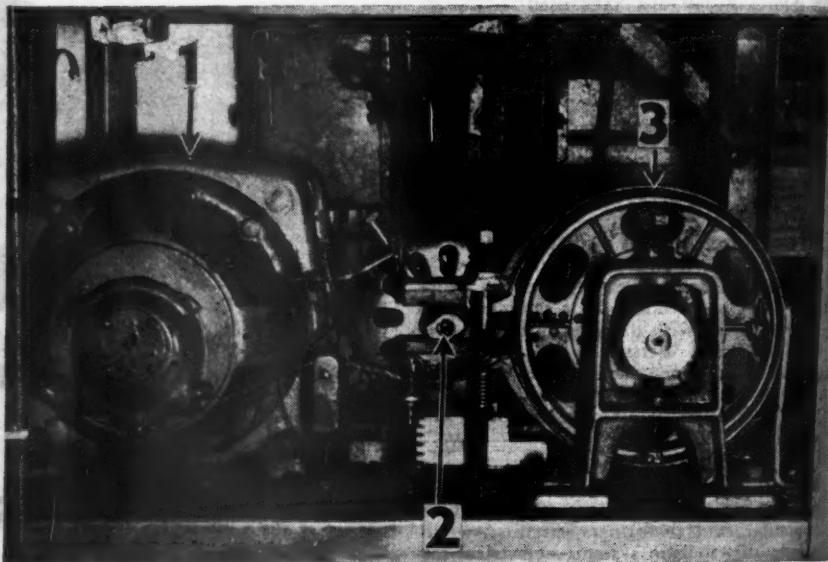
Motor Shops

[FROM PAGE 201]

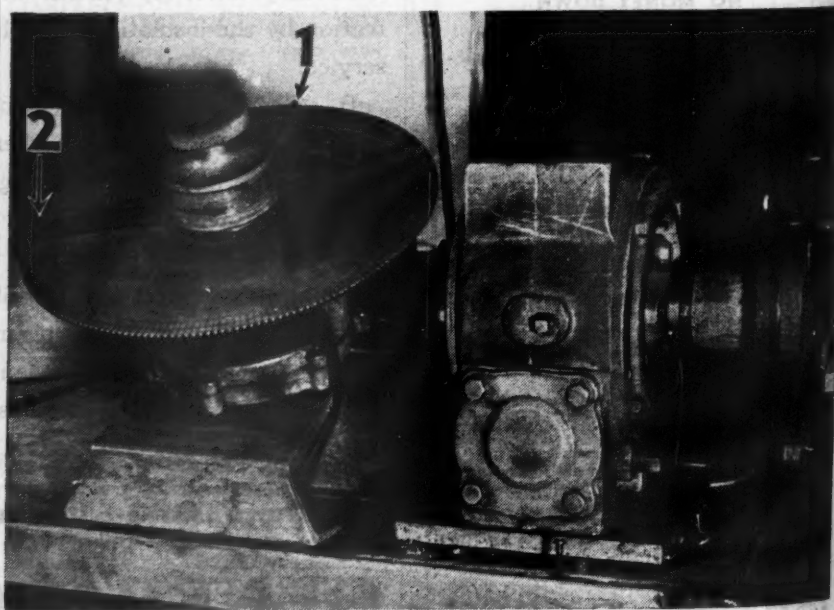
the two driving motor terminals, the rotor makes one-half revolution when the current is turned on and spreads the brake band arms (against the spring pressure) thus releasing the brake. When the counter arms meet and shut off the current, a spring and lever arrangement returns the brake motor rotor to its original position permitting the brake spring attachment to set the winding head brake.

In actual operation the unit works like this: For a 30 turn coil, the stationary pointer on the counter disc is

set at the notch marked "30"; the revolving pointer is set back to "zero" (this can be done through a ratchet arrangement) and the motor is started. When the revolving pointer reaches the stationary one at "30", the magnetic switch on the motor is kicked out and the winding head brake is set. The operator can keep an eagle eye on the coil being wound since there is no need for watching a "counter". This is particularly advantageous when two or more wires per turn are being used, since proper seating of the wires in the form groove is vitally important. A definite speed up in coil winding has been effected by this machine at the Loyd shop.



BRAKE MECHANISM consists of brake motor (2) connected across terminals of driving motor (1). When machine starts brake motor (with one-half of rotor cut out) makes one-half revolution counterclockwise releasing brake band (3). When current is shut off spring returns brake motor rotor to original position and brake spring sets brake band.



COUNTER DISC automatically shuts off winding head driving motor when movable pointer (1) meets the stationary pointer (2) which can be set at any number of turns up to 200. Brake on winding head is immediately set to prevent coasting.

Collecting Slow Accounts

[FROM PAGE 62]

the statement of a good pay customer. He may consult the salesman who handles that customer to learn the reason for the unusual case. The collector may decide to let such an item run another month and throw the statement duplicate away.

Second—On the 21st the collector phones local customers and writes out-of-town customers. The first contact is to establish the correctness of the charge and the customer's knowledge that it is past due. The result is briefly recorded (with date) on the statement duplicate. Frequently duplicate invoices are requested by the customer and they are mailed immediately and marked for the attention of the person requesting them. A notation of this is made on the collector's copy of the statement. Other customers will make promises which must be similarly recorded.

Third—By this time the collector is on the offensive. He has probably cleared up all customer questions about all the charges. He now has a complete file having also attached to the statements carbon copies of letters written to out-of-town customers. From here on each slow account becomes an individual case requiring its own individual follow-up.

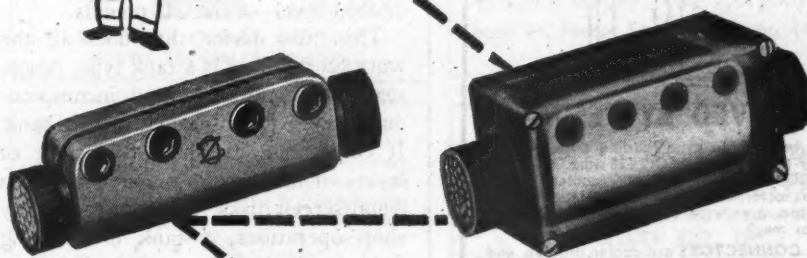
Fourth—All checks received must be examined by the collector so that he knows when payments are received. This check-up is obviously important. The entire file of past due accounts is examined daily and every one that warrants follow-up gets it. By the end of the month, half of the accounts (now 60 or more days old) have been paid. By the next 15th day only one or two stragglers remain and sometimes the slate is clean. A clean slate on the 15th means a job well done because a new lot of accounts comes to the collector on that date.

Collecting as an Art

Collecting is too often considered one of the "dregs of business". Most people shun it. With the application of good common sense it can be made a pleasant and successful experience. By good planning it can be accomplished in an average of 15 to 30 minutes per day, about one minute per day per statement received on the 15th. It can be done. It is being done.

NO SOLDER NO TAPE NO LOOSE CONNECTIONS with O.Z. FITTINGS

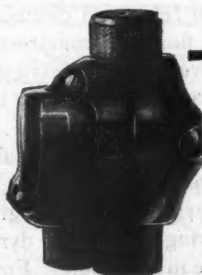
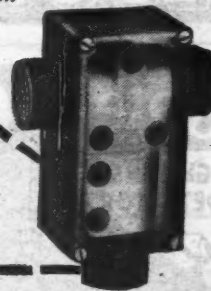
This group of electrical connectors and covers is designed to give:
POSITIVE CONTACT • EASE OF INSTALLATION
ACCESSIBILITY FOR MAINTENANCE • SALVAGE-ABILITY OF BOTH CONNECTOR AND COVER



TWO-WAY CONNECTORS—This fitting, illustrated here with and without cover, is used for joining two cables, of the same size, end to end in a straight line. The two-piece cover is made of Canvas Bakelite, attached with screws, making a neat compact insulation of high mechanical and dielectric strength. Built to accommodate cable sizes from No. 8 to 2000 Mcm.

T-CABLE TAPS, with COVER—

Where taps are required at a 90° angle to a main feeder, this small compact T-connector is ideal. Can be furnished with Canvas Bakelite cover, made in two pieces and fastened over fitting with screws. Eliminates taping; keeps out dirt.



PARALLEL GUTTER TAPS—These fittings consist of sturdy, compact cast copper alloy bodies assembled with steel socket-head cap screws. Covers of Canvas Bakelite similar to those furnished for other fittings, may be supplied. They eliminate taping and afford effective insulation and protection against dirt and grounds.

FITTINGS for EVERY PURPOSE ... from ONE SUPPLY SOURCE

In the new 144-page O.Z. Catalog, which illustrates, describes and gives prices on more than 160 electrical fittings consisting of—

CONDUIT FITTINGS • CABLE TERMINATORS • JUNCTION BOXES
SOLDERLESS CONNECTORS • POWER CONNECTORS • GROUNDING DEVICES

— you will find everything you need for new construction or reconversion projects. Write for this valuable guide to efficient and economical purchasing. A request on your business letterhead will bring a copy.

O.Z. ELECTRICAL MFG. CO.
262 BOND STREET • BROOKLYN, 2 N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

ILSCO Electrical Connectors



PROVED BY TESTS

Recent tests made by a leading switch manufacturer proved that ILSCO 225 amp. SOLDERLESS CONNECTORS ran 12% cooler than a cast connector of another manufacturer whose connectors are twice as heavy and cost four times as much.

ILSCO CONNECTORS are cooler, lighter, and cheaper because they're built from 100% electrolytic pure copper drawn right in our own plant. Cast connectors, of course, are made of alloy copper with poor conductivity.

Make the tests yourself... you'll appreciate ILSCO superiority

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

Safe-T-Glow

HIGH TENSION DETECTOR



SAFETY RULES call for that EXTRA precaution and additional RECHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages... prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.
Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE

Tests Everything Electrical from 100 to 550 Volts

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List \$1.50 (Priority A-7). Purchase thru regular electrical dealers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.

Economical Cleaning

[FROM PAGE 58]

pump (see diagram), three different circulating systems are obtained: (1) the used fluid which drained from the booth can be reused for the initial removal of heavy grease and dirt from equipment; (2) the clean and filtered fluid can be used for the final cleansing spray; and (3) the used fluid can be pumped from its storage tank, through the filter and back into the clean fluid tank. An automatic pressure bypass valve maintains nozzle pressure at the desired level—about 20 pounds.

The little device that does all the work on the fluid is a tank type, Alsop, sealed disk, filter located inconspicuously at the end of the clean fluid tank. It contains a cartridge consisting of layers of blotter like material between metal screen disks. Under present day shop operations, a tank of cleaning fluid is filtered four times before a filter renewal is necessary—meaning a renewal every two weeks. This may vary depending upon the amount of grease and dirt on the equipment cleaned—the dirtier the parts the more frequently the fluid must be filtered.

Considerable time in the cleaning operation is saved by using a double action, Hansen No. 90, spray gun which permits drying the equipment with a blast of compressed air—approximately 100 lb. per sq.in. pressure. Applying a certain pressure to the trigger of the gun releases a cleansing spray of cleaning fluid and compressed air. Additional pressure on the trigger cuts off the fluid and releases only the drying blast of air.

The new booth will handle any equipment that will physically fit into it. Excel's Joe Ferrari tells of thoroughly cleaning and drying a 3100-lb. dynamometer armature in 20 minutes. From the standpoint of material economy, Joe relates a saving of two barrels of cleaning fluid per month through re-filtering and reuse (former consumption was five barrels per month). Another economical touch is added—when the used fluid (a No. 10 mineral spirits solvent—non-explosive) is so saturated with oil that it is no longer effective as a solvent, it is refiltered again and stored in barrels. Later it is mixed with the heating plant fuel oil (approximately two parts of fuel oil to one part of oil saturated fluid). Since the fluid is non-explosive and, by this time highly saturated with filtered oil from the cleaned equipment, it mixes and burns well with fuel oil.

Big Job Organization

[FROM PAGE 59]

accountant was a cost accountant with a staff of two junior accountants, a warehouseman and 10 checkers handling materials records. The payroll (averaging approximately \$100,000.00 weekly) was handled by a junior accountant with the cooperation of a chief timekeeper and 19 field timekeepers and time checkers. Another junior accountant handled War Bonds. Compiling statistics gathered for the accounting department was a clerical force of 18. Employment was under the supervision of a personnel manager located in the general contractor's employment office.

The electrical work on the project was really divided into two distinct categories, as indicated on the accompanying chart. Until the buildings were completed, one by one, all work was of a construction nature. Once machinery began to roll into buildings, a machinery installation division was set up. The shaded areas in the blocks on the organization chart indicate the portion of the personnel allotted to this division. The nonshaded blocks are pure construction work; and divided duty between the two divisions is indicated by partially shaded blocks.

The spotty and uncertain delivery of machines presented another problem of coordination between the several subcontractors on the project. The ultimate goal was to have each machine set and connected as soon as possible after arrival at the job site. To facilitate and insure close cooperation on machinery installation, the general contractor drew up a field organization chart showing the names and field telephone numbers of all key personnel in the various trades concerned. With a copy of this chart in the office of each subcontractor, the coordination of the trades involved in getting machines into operation was effected with a minimum of delay, confusion and misunderstanding.

The organizational setup reviewed here is impressive; it may even seem large and somewhat complicated. It is. But, so was the project. Basically, however, it can be employed as a pattern for developing field organizations to handle electrical construction work—the magnitude and complexity, of course, depending upon the specific project at hand. One fact is paramount—unless an efficient field staff is organized at the job site, trouble will not be far around the corner.

Infra-Red Bake Tank

[FROM PAGE 59]

The others give added flexibility and capacity to the unit for the larger baking jobs which of necessity, for quick baking, require much more heat to penetrate into the innermost recesses to permanently set the varnishes used for conductor insulation.

Turntable Construction

Although turntables, as such, are frequently seen in motor shop practice, the specific construction of this unit is unique. Designed primarily to accommodate small drill armatures, this 34-inch diameter turntable is equipped with a double-ring, 1/2-inch conduit superstructure (similar to the tank support) with a 16-inch spacing between the two rings and platform. Each quarter segment of each ring (between the supporting uprights) is drilled to accommodate four pins equipped with a 3-prong, crow-foot support. To the lower end of each pin is fastened a spring clip to hold the armature shafts and coils during the baking period. In addition to its supporting function, this crow-foot serves another purpose which is important to uniform baking.

Assured of Even Bake

Mounted to the tank shell and extending just inside the turntable superstructure is an inverted U-shaped conduit bracket. As the turntable slowly revolves in the circle of heat lamps, fingers attached to this bracket (over the two rings) engage one of the crow-foot prongs and rotate the armature attached to the pin through 120 degrees for each revolution of the turntable. Thus each armature is assured of an even bake during its two-hour stay in the oven.

Motive power for this turntable is supplied by a motor mounted on a shelf directly behind the circuit breaker panels and below insulation placed directly beneath the turntable bed.

Oven Capacity

The oven has a "suspension" capacity of 32 drill armatures. Other equipment, such as larger stators, armatures, coils, etc., can be set on the turntable base and be baked with the batch of armatures. With a two-hour baking period, this oven can turn out 128 armatures in an eight-hour day—approximately 30 percent more than the average output of a skilled drill armature winder.

WHERE TO BUY

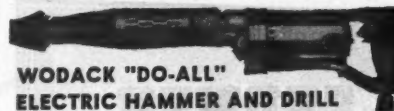
Equipment, Materials and Supplies for
Electrical Construction—Maintenance—Repairs



The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

**TURNTABLE
ANYTHING
ELECTRICAL
ON & OFF
REGULARLY**

DRILL CONCRETE THE EASY WAY



**WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL**

Saves time and labor installing expansion anchors. Two motions—reciprocal for hammer drilling—rotary for twist drilling. Drills masonry to 1 1/2" dia., metal 3/4". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, ball points, etc. Ask for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago 44, Ill.
Telephone AUstin 9866

A Good Habit

This Where To Buy Section supplements other advertising in this issue with additional announcements of products and materials of special interest and application in electrical construction, maintenance and repair. Make a habit of checking this page each issue.



for

**SAFETY'S SAKE
SODER-FLUX**

Underwriters' Approved

L. B. ALLEN CO., INC.
6715 Bryn Mawr Ave. Chicago 31, Ill.

SEARCHLIGHT SECTION

(Classified Advertising)

**EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE**

UNDISPLAYED

(Not available for equipment advertising)

10 CENTS A WORD. MINIMUM CHARGE \$2.00

Positions Wanted (full or part time individual salaried employment only), 1/2 the above rates payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words. Discount of 10% if full payment is made in advance for 4 consecutive insertions.

New advertisements received by Oct. 24th appear in Nov. issue, subject to space limitations.

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Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is \$8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured 1/4" vertically on one column, 3 columns—30 inches—to a page.

REPRESENTATIVE AVAILABLE

ESTABLISHED SALES agency in Pacific Northwest desires additional electrical lines have own warehouse and live selling organization. Give complete post-war plans. RA-323, Electrical Contracting, 68 Post Street, San Francisco 4, Cal.

TECHNICALLY TRAINED man, 17 years wide industrial experience would like connection as sales representative for electrical manufacturer or distributor. Willing to travel. W. C. Brooks, Cleveland 11, Ohio.

WANTED

ANYTHING within reason that is wanted in the field served by Electrical Contracting can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

ELECTRIC EQUIPMENT CO.

63 CURLEW ST. - P.O. BOX 51
ROCHESTER 1, NEW YORK

NEW AND REBUILT

They "talk your language"

the other 17,000 and more subscribers of Electrical Contracting "talk your language"—are interested in everything pertinent to the field served by this paper—that's why advertisements of Employment, Equipment and Business Opportunities in the Searchlight Section of Electrical Contracting usually bring prompt response.

**GEDNEY
FITTINGS**

FOR ELECTRICAL WIRING APPLICATIONS

GEDNEY ELECTRIC COMPANY
820 BUILDING - RADIO CITY - NEW YORK, N. Y.

Insto-gas



Insto-gas Torches and Furnaces actually cut soldering costs down to one-half for electricians. A cylinder of Insto-gas lasts at least FIVE times as long as one of compressed gas of about the same size. Other savings result from the clean, non-oxidizing Insto-gas flame which leaves no smoke, soot or grease to cause faulty joints. Besides, it lights instantly and won't blow out. Listed by both Underwriter's and Factory Mutuals Laboratories.

INSTO-GAS CORPORATION **Detroit 7, Mich.**
Please mail me your Insto-Gas Bulletin and
tell me how to furnish Priority rating. Send me
name of nearest distributor.

NAME

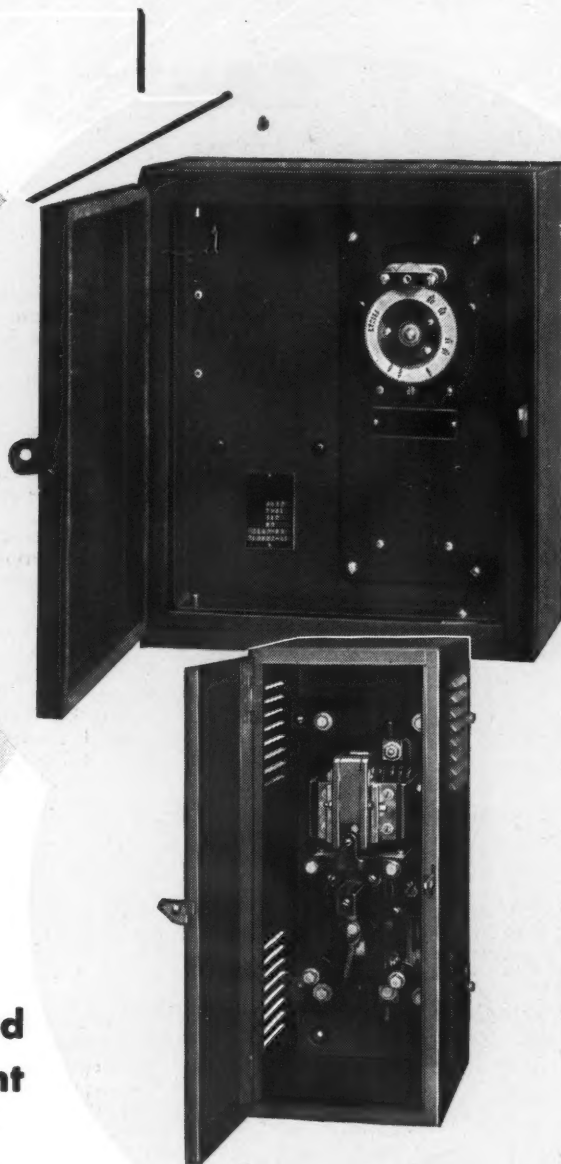
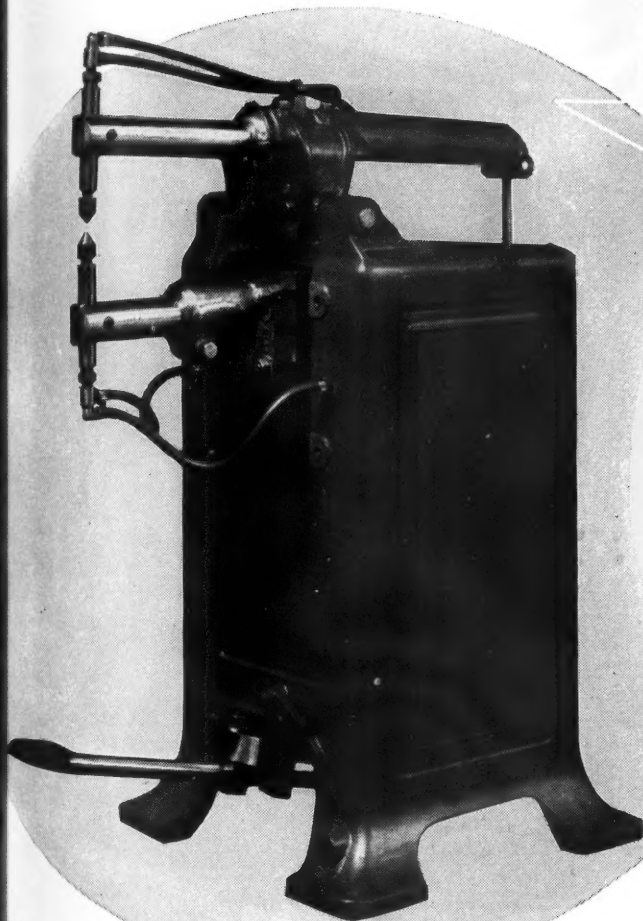
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How to modernize Spot Welders for as little as \$105⁰⁰!



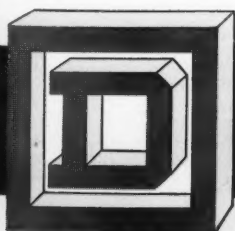
Safront Timer and High-Speed Contactor eliminate human element and assure uniform weld quality

Spoilage goes down and production goes up when welding power is controlled *automatically*. And it's a simple matter to equip machines, now in service, with modern timers and contactors for that purpose.

Your nearest Square D Field Engineer will be glad to work with you in analyzing and modernizing welding equipment for your industrial customers. Don't overlook this source of profitable business.

Top—TYPE TBS-1 SAFRONT TIMER automatically controls duration of welding current. All "live" parts are behind a protective panel. Timer adjustments can be made simply by turning the small knurled wheel on the panel front. Timer dial is calibrated 3 to 100 cycles.

Bottom—HIGH-SPEED CONTACTOR closes and opens the circuit to the primary of the resistance welding transformer. It is designed specifically for fast operation and heavy loads. Notice ample ventilation and generous wiring space. Knockouts for conduit entrance are provided in both top and bottom.



SQUARE D COMPANY

DETROIT

MILWAUKEE

LOS ANGELES

CHOOSE *G-E* SERVICE ENTRANCE CABLE (TYPE SE)

- *Economical*
- *Safe*
- *Easy to Install*



APPROVED BY
THE UNDERWRITERS'

Use this sturdy, tough cable from entrance caps to meter equipment. It can be installed directly on the outside of buildings without conduit protection. It is flexible — can be bent edgewise without damaging the conductors. It is compact, light in weight and requires only the simplest of fittings.

G-E service entrance cables consist of one or more Type R insulated conductors and a concentrically-applied stranded bare conductor. The conductors are protected by a heavy, watertight, weatherproof over-all covering. These cables are also available with flat, galvanized steel armor wound spirally under the outer covering.

FOR FURTHER INFORMATION on G-E service entrance cable or building wires or wiring devices, see the nearest G-E Merchandise Distributor or write to Section CDW1041-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

BUY WAR BONDS AND HOLD THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

GENERAL  ELECTRIC



FOR
COMFORTABLE LIVING
AND
INVESTMENT
PROTECTION

On adequate wiring Philip A. Benson, president of The Dime Savings Bank of Brooklyn, N. Y., says, "We shall require adequate wiring in the new post-war homes that we finance, not only as a guarantee of comfortable living for the mortgagor, but also as a measure of protection for our investment."



G-E BUILDING WIRES AND WIRING DEVICES

General Electric offers building wires and wiring devices for every purpose including Type SN and Type SNW small diameter Flamenol* Building Wire and hundreds of wiring devices—switches, lampholders, outlets, etc.

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